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INDIVIDUAL WELL REPORT
FROM THE PROGRAM ON

CHARACTERIZATION AND ANALYSIS OF DEVONIAN SHALES AS RELATED TO RELEASE OF GASEOUS HYDROCARBONS

WELL C-336 MARTIN COUNTY, KENTUCKY

by

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and M. J. Snyder

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INTRODUCTION AND SUMMARY

Partial data on the characterization of C-336 (Martin County, Kentucky) shales were reported in the Sixth Quarterly Technical Progress Report, January through March 1978. Total characterization data and interpretation are presented in this Individual Well Report on shales from Well C-336 (Ky #3).

Coring of C-336 well was accomplished in November 1976. Samples were obtained at depths from 2479 to 3371 feet. 119 samples were collected for Battelle and 90 for other DOE contractors.

Shales from Well C-336 exhibit relatively high hydrocarbon gas contents. Oxygen to nitrogen ratios in the gas analysis continue to be very low, leading to various possibilities mentioned in previous reports.

Wide range in carbon contents characterizes the chemical composition of the organics in these shales. Positive relationships exist between the hydrocarbon gas contents and chemical data (carbon and hydrogen). Relationships between the physical data and gas contents are not as distinct, though, an inverse relationship does exist between the bulk density and hydrocarbon gas contents.

OBJECTIVE AND SCOPE

The objective of this program is to determine the relationships between shale characteristic, hydrocarbon gas content, and well location to provide a sound basis for defining the productive capacity of the Eastern Devonian Shale deposits and for guiding research, development, and demonstration projects to enhance the recovery of natural gas from the shale deposits. The program includes a number of elemental tasks as a part of the Resource Inventory and Shale Characterization subprojects of DOE's Eastern Gas Shales Project and is designed to provide a wide variety of support data for that project.

A large number of core samples of gas bearing Eastern Devonian Shale will have been examined by the end of the program. After the characterization data for individual wells have been compiled, attempts will be made to establish the interrelationships between the shale characteristics, the hydrocarbon gas content, and well locations from which the samples were obtained, employing the Automatic Interaction Detection (AID) Analysis.

The following tasks comprise the total efforts in this research program:

Task	Descriptive Title
1	Coring Sampling
2	Gas Content and Gas Release Kinetics
3	Chemical Characterization of Shale
4	Physical Characterization of Shale
5	Lithology of Shale
6	Data Interpretation and Correlation

A. ANALYSIS AND DISCUSSION OF THE CHARACTERIZATION DATA

Detailed descriptions of the experimental procedures employed in the execution of the elemental tasks described were reported in the Appendix of the Fifth Quarterly Technical Progress Report (ORO-5205-5) submitted to U.S./DOE in January 1978.

Task 1. Core Sampling

The coring of the C-336 Well (Martin County, Kentucky; API Well Code No. 31020) was completed in November 1976. The coring was begun at 2479 feet and stopped at 3371 feet, requiring 18 barrels to complete. 119 samples were collected for Battelle and 90 samples for other DOE contractors. Additional pertinent well information and field sampling data are provided in Tables 1 and 2.

Task 2. Gas Contents and Release Rates

The initial gas release data for Well C-336 are summarized in Table 3. The data include total hydrocarbon gases, nitrogen, oxygen, and carbon dioxide, all of which accumulate in the free space inside sealed canisters. Upon sealing the canisters in the field, the canisters are transported to the laboratory and stored for at least three weeks prior to "free" gas analysis.

A significant feature of the gas analysis results is the very low oxygen to nitrogen ratios, as has been the case with samples from all the wells thus far studied. Speculative explanations for this observation were presented in the individual well report on C-1 shales.* Further research in the laboratory would shed further light as to what processes are taking place which result in oxygen difficiency in the system.

* R.S. Kalyoncu, et al., Individual Well Report from the Program on Characterization and Analysis of Devonian Shales as Related to Release of Gaseous Hydrocarbons, Well C-1, published March 22, 1979.

Statistical parameters on the gas analysis are presented in Table 4. Total hydrocarbons average 16.57 percent by volume of total gases, methane being the major hydrocarbon gas with an average volume percent of 10.23. Average volume of hydrocarbon gas is 0.38 cubic foot of gas per cubic foot of shale.

Natural gas contents of shales vary randomly with depth as illustrated in Figure 2, though it may be possible to observe two zones; one where the hydrocarbon gas contents somewhat decrease with depth (between 2424 and 2824 feet) and one where the hydrocarbon gases increase with increasing depth (2824 and 3424 feet).

Task 3. Chemical Characterization Data

Chemical analysis data (carbon, hydrogen, and nitrogen) are summarized in Table 5. The carbon values range from 0.5 to 7.6 percent with hydrogen values ranging between 0.4 and 1.0 percent by weight of total solids. Total carbon values are plotted as a function of depth in Figure 3. No distinct pattern exists between carbon contents and depth, though bands of increasing carbon contents with depth are noticeable at three distinct intervals of depth, namely, 2425 - 2724 feet, 2824 - 3034 feet, and 3124 - 3424 feet. Figure 4 illustrates the hydrogen content of the shales as a function of depth. Three distinct bands of constant hydrogen contents with depth are apparent at values 0.50, 0.7, and 0.8 percent hydrogen. H/C atomic ratios, as presented in Figure 5, exhibit a wider scatter than either carbon or hydrogen values. However, a pattern resembling more closely the carbon profile is apparent from Figure 5.

Figure 6 illustrates the relationship between natural gas and carbon contents. A steady increase in natural gas contents with increasing carbon content is quite apparent. Three to four bands of constant hydrogen content are seen with varying natural gas contents, as shown in Figure 7.

Task 4. Summary of Physical Characterization Data

Partial physical characterization data are summarized in Table 6. Among the data obtained are densities, porosity, surface area and permeability. The statistical parameters on the physical data presented in Table 6 are given in Table 7. Bulk density values range from 2.64 to 2.68 with a mean value of 2.66. Porosities (calculated from the density data) vary between 2.43 and 3.29 percent with a mean value of 2.86 percent. Surface areas range from 2.25 to 2.83 having a mean value of 2.54 m^2/g.

A slight increase in the natural gas contents with decreasing bulk density values is somewhat apparent from Figure 8. Such relationship is much more pronounced between the bulk density and carbon values as illustrated in Figure 9. Hydrogen contents also show an increase with decreasing bulk density values. This is shown in Figure 10.

Figure 11 illustrates the porosity profile (calculated from the density data) of C-336 shales with depth. Increase in porosity values with depth is apparent throughout several depth intervals from the Figure. Natural gas contents show slight decrease with increasing porosities for the C-336 shales. This relationship is shown in Figure 12. Similar relationship between the porosity and carbon contents is apparent from Figure 13. Hydrogen contents, illustrated in Figure 14, also fit the similar pattern of natural gas and carbon profiles with increasing porosities associated with decreasing hydrogen contents.

The apparent observations in Figure 12 through 14 can somewhat be termed anomolous, as, for example, one could possibly expect high porosity values to be associated with high hydrocarbon gas contents. On the other hand, low hydrocarbon gas contents with increasing porosity values could be explained by the possibility that the hydrocarbon gases might more easily escape the more porous shale structure prior to sealing the canisters. This point once again illustrates the importance of making additional gas flow measurements at the well site to complement the laboratory gas analysis data on the sealed shale samples.

The porosity values calculated from the density data are presented in Table 8. Table 9 summarizes the mercury intrusion porosity values for C-336 shales.

Task 5. Shale Lithology

Lithology of the shales was studied using SEM/EDAX and the petrographic microscope as in the past with other shale samples. Table 10 summarizes the elemental analyses of seven C-336 shale samples as determined by Energy Dispersive X-ray Analysis (EDAX).

Figures 15 through 21 are SEM micrographs of seven C-336 shale samples. Five of the seven samples were relatively high in illite content, the other two containing relatively very high or very low amounts. Analyses supported this microscopic observation to the extent that the K contents of the samples containing the illite in the extremes were also the highest and lowest. Microscopically, the quartz content of all but two of the samples was judged to be medium. Two of the samples appeared to have a very low quartz content, these same two having a high illite content as noted both by microscopic observation and a high K and relatively low Si content by analysis. The sample appearing to have the lowest illite content contained the highest amount of Si by analysis. It did not appear, microscopically, to have a high quartz content, but it was heavily stained, which may have interfered with the quartz identification. Pyrite content of the samples was variable, ranging from scarce to abundant. Microscopic observation showed an absence or very little occurrence of carbonate minerals. This was generally supported by analysis. One sample, however, contained a significant amount of Ca, which was not accounted for in the powder sample examined microscopically.

Task 6. Data Correlation Analysis

Analysis of the laboratory generated physical property, and gas data and the wire log well data has been carried out using the Automatic Interaction Detection (A.I.D.) technique. Results similar to those of previous studies were found in this work, as we have again seen some good correlations between physical data (density and porosity) and hydrocarbon gas contents.

Figure 22 shows how the hydrocarbon gas contents are split when the potential splitting variables include all of the laboratory data and well log data. The first split is based on the bulk density and the split is normal, that is, low density is associated with high gas. The second split, based on gamma ray, lends further support to the value of this tool to identify regions of high gas. Based on our previous observations, however, the predictive quality of the gamma radiation to gas content is tied to the maturity of the organic material in the shale. The fourth split, made on closed porosity, is interesting in that the split is opposite of what might be expected. That is, low closed porosity is associated with higher gas. The explanation for this is not clear, but may be tied to the fact that the total porosity of these specimens does not show a great deal of variation, but the ratio of open to closed porosity changes. Therefore the split on closed porosity may indicate an increase in open porosity.

Figure 23 summarizes the results of comparing the hydrocarbon gas contents to the well log data. The most important observation here is that there is a correlation between exposure time or on-surface time (the time between the core leaving the well and being sealed in canisters) and gas content. The specimens with the shorter exposure time display the most gas. This points out the greatest liability of these analyses, that is, care should be taken in treating these gas contents as absolute, as they have undoubtedly lost gas prior to sealing. Furthermore, since the gas values show a dependence on porosity, it is not reasonable to assume all of the specimens lose an equal portion of gas even when the exposure time is the same.

Figures 24 and 25 show the results of our examination of open porosity. These analyses are particularly encouraging in that they show a very good correlation between Schlumberger's resistivity data and porosity. The correlation is that low resistivity is associated with high porosity. The same type of correlation is seen with the low porosity group in Figure 25 where high conductivity is associated with high porosity.

In figure 24 there is an apparent anomoly when two groups are split on the basis of density with higher densities being associated with higher open porosity. These splits are not particularly productive in that they do not markedly increase overall predictability. The explanation for this behavior is not clear. The probable explanation, however, is that this is a mathematical anomoly arising from the manner of calculating porosity based on density measurements. It may also be that as the shale is densified it is the closed porosity that is reduced.

TABLE 1. WELL DATA FOR C-336

LOCATION: MARTIN COUNTY, KY

ALTITUDE: 933 FEET

COORDINATES: 37.46 (DEGREES.MINUTES) LATITUDE
82.29 (DEGREES.MINUTES) LONGITUDE

CORING BEGAN AT 2429 FEET AND STOPPED AT 3371 FEET. IT TOOK 18 BARRELS TO COMPLETE.

SAMPLES WERE RETURNED TO BATTELLE ON 11/ 6/76.

THERE WERE 119 SAMPLES COLLECTED FOR BATTELLE AND 90 SAMPLES COLLECTED FOR OTHERS.

RUN INFORMATION FROM WELL C-336

RUN NO. 1	CORING BEGAN AT 2429 FEET AND CORING STOPPED AT 2487 FEET. THE AVERAGE CORING RATE IS 7.12 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 3.42 HOURS
RUN NO. 2	CORING BEGAN AT 2487 FEET AND CORING STOPPED AT 2545 FEET. THE AVERAGE CORING RATE IS 8.28 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.00 HOURS
RUN NO. 3	CORING BEGAN AT 2545 FEET AND CORING STOPPED AT 2583 FEET. THE AVERAGE CORING RATE IS 8.16 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 4.42 HOURS
RUN NO. 4	CORING BEGAN AT 2583 FEET AND CORING STOPPED AT 2641 FEET. THE AVERAGE CORING RATE IS 7.76 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.25 HOURS
RUN NO. 5	CORING BEGAN AT 2641 FEET AND CORING STOPPED AT 2700 FEET. THE AVERAGE CORING RATE IS 7.76 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.57 HOURS
RUN NO. 6	CORING BEGAN AT 2700 FEET AND CORING STOPPED AT 2757 FEET. THE AVERAGE CORING RATE IS 5.82 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 3.42 HOURS

TABLE 1. (Continued)

RUN INFORMATION FROM WELL CONTINUED C-336

RUN NO. 7	CORING BEGAN AT 2757 FEET AND CORING STOPPED AT 2815 FEET. THE AVERAGE CORING RATE IS 8.29 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.83 HOURS
RUN NO. 8	CORING BEGAN AT 2815 FEET AND CORING STOPPED AT 2873 FEET. THE AVERAGE CORING RATE IS 6.92 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.13 HOURS
RUN NO. 9	CORING BEGAN AT 2873 FEET AND CORING STOPPED AT 2931 FEET. THE AVERAGE CORING RATE IS 7.70 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.33 HOURS
RUN NO. 10	CORING BEGAN AT 2931 FEET AND CORING STOPPED AT 2989 FEET. THE AVERAGE CORING RATE IS 6.67 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.33 HOURS
RUN NO. 11	CORING BEGAN AT 2989 FEET AND CORING STOPPED AT 3039 FEET. THE AVERAGE CORING RATE IS 4.90 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 3.17 HOURS
RUN NO. 12	CORING BEGAN AT 3039 FEET AND CORING STOPPED AT 3097 FEET. THE AVERAGE CORING RATE IS 6.38 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 3.50 HOURS
RUN NO. 13	CORING BEGAN AT 3097 FEET AND CORING STOPPED AT 3155 FEET. THE AVERAGE CORING RATE IS 7.43 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.88 HOURS
RUN NO. 14	CORING BEGAN AT 3155 FEET AND CORING STOPPED AT 3213 FEET. THE AVERAGE CORING RATE IS 7.98 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.67 HOURS
RUN NO. 15	CORING BEGAN AT 3213 FEET AND CORING STOPPED AT 3272 FEET. THE AVERAGE CORING RATE IS 4.52 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 1.68 HOURS
RUN NO. 16	CORING BEGAN AT 3272 FEET AND CORING STOPPED AT 3312 FEET. THE AVERAGE CORING RATE IS 9.64 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.75 HOURS
RUN NO. 17	CORING BEGAN AT 3312 FEET AND CORING STOPPED AT 3370 FEET. THE AVERAGE CORING RATE IS 6.52 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.28 HOURS
RUN NO. 18	CORING BEGAN AT 3370 FEET AND CORING STOPPED AT 3411 FEET. THE AVERAGE CORING RATE IS 9.28 MINUTES PER FOOT. THE SAMPLES WERE ON THE SURFACE IN 2.17 HOURS

TABLE 2. FIELD SAMPLING DATA FOR WELL C336

SAMPLE ID.	COLOR	ON SURFACE TIME	BARREL NO	SEQ NO.
C336-2434.	N3	1.33	1	1
C336-2444.	N3	1.52	1	2
C336-2454.	N3	1.68	1	3
C336-2463.	N3	1.70	1	4
C336-2464.	N3	1.76	1	5
C336-2474.	N3	1.86	1	6
C336-2494.	N3	1.68	2	7
C336-2504.	N4	1.75	2	8
C336-2514.	N3N4	1.92	2	9
C336-2514.Z	N4	2.00	2	10
C336-2524.	N5	2.06	2	11
C336-2534.	4GY4/1	2.16	2	12
C336-2545.	5GY4/1	.94	3	13
C336-2555.	5G4/1	1.12	3	14
C336-2565.	N3	1.25	3	15
C336-2565.Z	N3	1.32	3	16
C336-2575.	5GY4/1	1.42	3	17
C336-2586.		1.46	3	18
C336-2588.	N4N5	2.67	4	19
C336-2595.	N4N5	2.70	4	20
C336-2607.	N4	3.00	4	21
C336-2617.	N4	3.16	4	22
C336-2617.Z	N4	3.07	4	23
C336-2637.	N4	3.56	4	24
C336-2646.	N5	1.60	5	25
C336-2656.	5GY2/2	1.67	5	26
C336-2666.	N4	1.92	5	27
C336-2666.Z	N4	2.00	5	28
C336-2676.	N3	2.03	5	29
C336-2686.A	N3	2.12	5	30
C336-2686.B	N3	2.15	5	31
C336-2696.	N4	2.33	5	32
C336-2705.	N2	2.25	6	33
C336-2715.	N2	2.37	6	34
C336-2725.	N2	2.58	6	35
C336-2725.Z	N2	2.67	6	36
C336-2735.	N2	2.78	6	37
C336-2745.	N2	2.85	6	38
C336-2755.	N2	2.95	6	39
C336-2763.	N2	2.10	7	40
C336-2773.	N1	2.25	7	41
C336-2784.	N1	2.53	7	42
C336-2784.Z	N1	2.58	7	43
C336-2793.	N3	2.62	7	44

TABLE 2. (Continued)

FIELD SAMPLING DATA FOR WELL C336

SAMPLE ID.	COLOR	ON SURFACE TIME	BARREL NO	SEG NO.
C336-2802.	N3	2.67	7	45
C336-2814.	N2N4	2.85	7	46
C336-2822.	N2	2.03	8	47
C336-2830.	N3N2	2.10	8	48
C336-2842.	N1N2	2.37	8	49
C336-2842.2	N3	2.37	8	50
C336-2852.	N2	2.40	8	51
C336-2862.	N4	2.45	8	52
C336-2872.	N4N5	2.62	8	53
C336-2881.	N3	1.75	9	54
C336-2891.	N4	1.90	9	55
C336-2901.	N4	2.05	9	56
C336-2901.2	N4	2.12	9	57
C336-2911.	5YR2/1	2.17	9	58
C336-2921.	N2N1	2.28	9	59
C336-2931.	N1N6N4	2.67	9	60
C336-2940.	N2	2.47	10	61
C336-2950.	N4	2.50	10	62
C336-2960.	N3	2.75	10	63
C336-2960.2	N3	2.67	10	64
C336-2970.	N3	2.80	10	65
C336-2980.	N4	2.85	10	66
C336-2990.	N3	3.05	10	67
C336-2999.	N4	3.25	11	68
C336-3009.	N3	3.33	11	69
C336-3019.	N3N4	3.67	11	70
C336-3019.2	N4	3.60	11	71
C336-3029.	N3	3.78	11	72
C336-3038.	N2	3.92	11	73
C336-3049.	N4	0.00	12	74
C336-3054.	N4	.97	12	75
C336-3069.	N2	1.28	12	76
C336-3069.2	N2	1.23	12	77
C336-3079.	N3N2	1.62	12	78
C336-3089.	N2	1.28	12	79
C336-3099.	N2	1.55	12	80
C336-3107.	N2N3	1.67	13	81
C336-3117.	5GY4/1	1.75	13	82
C336-3127.	5GY4/1	1.87	13	83
C336-3137.	5GY4/1	2.02	13	84
C336-3137.2	5GY4/1	1.98	13	85
C336-3146.	5GY4/1	2.08	13	86
C336-3157.	5GY4/1	2.16	13	87
C336-3166.	5B5/1	1.16	14	88
C336-3176.	5B5/1	1.22	14	89

TABLE 2. (Continued)

FIELD SAMPLING DATA FOR WELL C336

SAMPLE ID.	COLOR	ON SURFACE TIME	BARREL NO	SEQ NO.
C336-3186.	5GY4/1	1.36	14	90
C336-3186.Z	5GY4/1	1.42	14	91
C336-3196.A	5GY4/1	1.50	14	92
C336-3196.B		1.53	14	93
C336-3206.	5GY4/1	1.56	14	94
C336-3216.	5GY4/1	1.52	14	95
C336-3224.	5GY4/1	1.42	15	96
C336-3234.	5GY4/1	1.47	15	97
C336-3244.	5GY4/1	1.72	15	98
C336-3244.Z	5GY4/1	1.70	15	99
C336-3254.	5GY4/1	1.73	15	100
C336-3264.	5GY4/1	1.76	15	101
C336-3274.	N3	1.92	15	102
C336-3284.	5GY2/1	2.20	16	103
C336-3294.	5GY2/1	2.26	16	104
C336-3304.	5G3/1	2.42	16	105
C336-3304.Z	5B3/1	2.38	16	106
C336-3310.	5GY3/1	2.48	16	107
C336-3315.		2.48	16	108
C336-3325.	N3	1.70	17	109
C336-3335.	N2	1.67	17	110
C336-3345.	N4	1.88	17	111
C336-3345.Z	N4	1.87	17	112
C336-3355.	N3	1.92	17	113
C336-3365.	N2	1.97	17	114
C336-3375.	N2	2.08	17	115
C336-3384.	N2	1.33	18	116
C336-3394.	N2N1	1.66	18	117
C336-3404.	N2N1	1.87	18	118
C336-3404.Z	N2N1	1.87	18	119

MEAN EXPOSURE TIME 2.10

STANDARD DEVIATION OF EXPOSURE TIME .65

TABLE 3. INITIAL GAS RELEASE DATA: WELL C336

06/06/79

SAMPLE ID	PRESSURE TORR	BULK VOLUME CC	PORE VOLUME CC	POROSITY PCT.	METHANE	ETHANE	PROPANE	BUTANE	PENTANE	TOTAL HYDROC.	NITROGEN	OXYGEN	CARBON DIOXIDE	GAS RELEASED/ UNIT VOLUME OF SHALE	SEQ NO.
					GAS COMPOSITION, VOLUME PERCENT										
C336-2434.	760.	1324.	346.	.51	33.38	9.08	3.39	1.79	0.00	47.64	47.26	3.68	1.38	1.38	1
C336-2444.	1115.	369.	391.	1.11	28.61	6.88	3.30	1.71	0.00	40.50	53.42	4.70	1.39	1.16	2
C336-2454.	940.	1318.	432.	2.59	17.03	10.60	1.78	.40	0.00	29.81	60.21	7.24	2.74	.87	3
C336-2454.7	725.	732.	662.	2.67	.23	1.56	.22	.05	0.00	2.06	77.06	20.66	.21	.02	4
C336-2464.	1125.	315.	636.	.36	27.67	7.99	2.51	.62	0.00	38.79	55.29	3.47	2.46	.74	5
C336-2473.	770.	843.	607.	.29	28.67	9.66	4.16	.46	.16	43.11	52.49	.74	3.64	.61	6
C336-2494.	750.	803.	547.	1.75	19.12	5.70	2.50	.96	0.00	28.28	61.23	7.33	3.13	.40	7
C336-2504.	725.	375.	575.	.69	18.22	9.73	2.90	1.39	0.00	32.24	57.84	6.41	3.51	.47	8
C336-2514.	750.	918.	542.	1.12	8.91	2.46	.71	0.00	0.00	12.08	71.72	12.51	3.68	.21	9
C336-2514.7	740.	401.	451.	6.71	0.00	0.00	0.00	0.00	0.00	0.00	77.97	21.94	.05	0.00	10
C336-2524.	775.	761.	600.	4.54	6.70	1.60	.05	.01	0.00	8.36	79.60	9.50	1.90	.09	11
C336-2534.	700.	1122.	324.	1.92	2.09	.54	.42	.01	0.00	3.06	79.30	16.57	.94	.10	12
C336-2545.	725.	954.	466.	2.60	1.09	1.24	.33	0.00	0.00	2.66	80.02	15.53	1.45	.05	13
C336-2555.	725.	1056.	334.	1.86	.38	0.00	.42	0.00	0.00	.80	77.66	21.13	.41	.02	14
C336-2565.	810.	903.	457.	2.63	13.69	5.02	1.96	.70	0.00	21.37	70.07	2.64	5.30	.50	15
C336-2565.7	725.	1043.	417.	5.19	1.48	1.96	.59	.21	0.00	4.24	78.18	17.23	.42	.10	16
C336-2575.	710.	1065.	395.	2.22	2.06	1.97	1.81	.28	0.00	6.12	77.06	16.32	.50	.16	17
C336-2585.	800.	900.	461.	1.69	1.38	.28	.30	.02	0.00	1.98	79.21	18.67	14.26	.04	18
C336-2588.	740.	843.	607.	2.27	0.00	0.00	.48	0.00	0.00	.48	77.87	21.49	.17	.01	19
C336-2595.	760.	670.	772.	1.74	.18	0.00	.14	.02	0.00	.34	79.00	19.29	1.38	.00	20
C336-2607.	740.	1036.	416.	3.63	4.77	1.61	.72	.98	0.00	8.08	77.20	13.20	2.40	.20	21
C336-2617.7	750.	1136.	252.	4.74	0.00	0.00	.30	0.00	0.00	.30	77.24	22.36	.12	.01	23
C336-2637.	750.	947.	503.	1.97	.21	.19	0.00	0.00	0.00	.40	78.39	21.21	.97	.01	24
C336-2646.	750.	901.	469.	2.17	.13	0.00	.26	0.00	0.00	.39	77.41	21.76	.34	.01	25
C336-2656.	750.	922.	528.	7.03	10.41	7.27	1.28	.97	0.00	19.93	67.56	7.29	5.22	.34	26
C336-2666.	770.	843.	607.	3.17	11.28	9.34	2.67	1.40	.03	24.72	63.07	7.66	4.56	.34	27
C336-2665.7	710.	936.	464.	.47	9.70	4.06	3.62	.58	.18	18.14	79.78	1.32	.76	.36	28
C336-2676.	759.	927.	523.	4.20	5.62	5.06	1.58	.37	0.00	12.63	70.19	13.32	3.57	.22	29
C336-2686.A	725.	1092.	453.	2.25	8.79	3.69	2.45	.63	.15	15.71	68.93	11.40	3.91	.15	30
C336-2686.B	740.	1054.	396.	3.15	3.84	3.05	.94	.24	0.00	8.07	71.47	16.90	3.56	.08	31
C336-2696.	740.	1016.	436.	1.31	3.47	3.95	1.57	.51	0.00	9.50	71.50	16.93	2.07	.22	32
C336-2706.	725.	816.	636.	5.85	4.67	2.47	2.12	.52	.17	9.95	71.67	15.42	3.00	.12	33
C336-2715.	725.	1001.	449.	.66	.71	.50	.57	.12	0.00	1.90	77.52	18.96	2.06	.04	34
C336-2725.	725.	913.	637.	.62	1.26	.95	1.05	.28	.13	3.67	75.09	18.65	2.59	.04	35
C336-2725.7	725.	1113.	337.	4.41	.45	.50	.98	.08	0.00	2.01	78.45	18.76	1.52	.02	36
C336-2735.	725.	1002.	355.	2.12	1.36	.84	1.73	.19	.08	4.20	74.39	18.68	2.73	.04	37
C336-2745.	745.	0.	0.	.66	10.12	2.69	2.73	.59	.18	16.42	72.33	4.49	6.85	I	38
C336-2755.	725.	1157.	293.	6.72	.46	.32	.46	.35	0.00	1.59	77.18	20.33	.99	.06	39
C336-2763.	725.	1142.	364.	.77	.95	.52	.49	.16	0.00	2.12	79.12	16.33	2.43	.06	40
C336-2773.	750.	1120.	330.	.84	1.75	.91	1.04	.66	.25	4.66	76.08	17.36	1.88	.16	41
C336-2784.	725.	1129.	321.	3.10	3.69	1.25	.37	.29	.17	5.77	75.09	16.12	2.99	.06	42
C336-2784.7	725.	1018.	432.	.73	3.09	1.41	1.38	.23	1.25	7.36	73.32	15.51	3.80	.17	43
C336-2794.	720.	1001.	353.	.79	.60	.32	.39	.04	0.00	1.35	78.39	19.55	.85	.01	44
C336-2802.	760.	1121.	329.	2.39	1.35	.59	.64	.03	0.00	2.61	77.63	17.54	2.19	.03	45
C336-2814.	750.	976.	474.	.85	.74	.54	.52	.09	0.00	1.88	78.22	18.21	1.70	.04	46

TABLE 3. (Continued)

INITIAL GAS RELEASE DATA: WELL C336

04/06/79

SAMPLE ID	PRESSURE TORR	FREE VOLUME CC	CORE VOLUME CC	POROSITY PCT.	METHANE	ETHANE	PROPANE	BUTANE	PENTANE	TOTAL HYDROC.	NITROGEN	OXYGEN	CARBON DIOXIDE	GAS RELEASED/ UNIT VOLUME OF SHALE	SEQ NO.
					GAS COMPOSITION, VOLUME PERCENT										
C336-2822.	760.	1046.	405.	5.12	.78	.78	.42	.02	0.00	2.00	79.61	15.76	2.62	.02	47
C336-2830.	760.	1005.	445.	1.51	.54	.24	.37	.02	0.00	1.17	75.99	21.86	.98	.03	48
C336-2842.	770.	1237.	213.	1.95	.44	.31	.47	.03	0.00	1.25	77.16	21.07	.49	.07	49
C336-2842.7	760.	1244.	206.	2.06	.52	.35	.49	.05	0.00	1.41	77.48	19.60	1.49	.09	50
C336-2852.	750.	978.	472.	2.21	3.30	1.50	1.10	.03	.09	6.02	78.10	13.80	1.80	.12	51
C336-2862.	725.	980.	470.	4.13	15.55	4.79	1.11	.72	.62	22.80	65.59	5.09	6.55	.22	52
C336-2872.	730.	987.	463.	2.34	5.93	1.63	1.12	.28	0.00	8.96	74.76	11.55	4.62	.09	53
C336-2881.	875.	1055.	395.	1.14	14.30	2.87	2.48	.91	0.00	21.06	68.50	3.84	6.53	.65	54
C336-2891.	775.	1192.	258.	1.69	2.94	.88	.66	.18	0.00	4.66	77.71	15.92	1.71	.22	55
C336-2901.	750.	1042.	403.	.76	9.99	2.52	1.97	.44	.19	15.01	72.34	8.42	4.24	.38	56
C336-2901.A	775.	1178.	272.	4.15	3.60	.87	.73	.24	0.00	5.53	78.50	15.09	.87	.24	57
C336-2911.	820.	1278.	172.	.51	8.77	4.05	1.51	1.00	.02	15.35	69.87	10.83	4.17	1.23	58
C336-2921.	840.	0.	0.	.24	4.62	1.51	1.80	.50	0.00	8.43	73.63	16.93	1.04	1	59
C336-2931.	910.	971.	479.	1.47	8.44	1.80	1.50	.34	.36	12.44	73.59	10.90	3.06	.27	60
C336-2940.	760.	994.	456.	2.99	25.24	9.20	6.06	1.86	.97	43.33	49.79	.78	6.13	.95	61
C336-2950.	725.	1099.	351.	4.41	4.79	1.35	1.49	.33	.33	8.79	75.75	11.62	3.81	.08	62
C336-2960.	650.	997.	453.	.68	28.27	8.53	6.29	1.64	.44	45.17	48.41	3.21	3.21	1.24	63
C336-2969.7	840.	1121.	329.	.82	25.23	7.85	5.47	1.39	.31	40.25	52.92	5.26	1.52	1.52	64
C336-2970.	825.	1133.	317.	.35	21.19	7.85	5.54	1.79	1.09	37.66	54.45	4.43	3.46	1.46	65
C336-2980.	725.	937.	513.	2.24	9.49	2.19	1.34	.27	.20	13.49	74.37	9.49	2.36	.23	66
C336-2990.	760.	1143.	307.	.45	15.65	7.57	5.49	2.04	1.28	32.67	57.38	6.19	4.39	1.19	67
C336-2999.	750.	894.	556.	3.44	4.00	.90	1.10	.70	.23	6.93	76.58	15.91	.67	.11	68
C336-3004.	725.	1015.	435.	4.71	20.58	8.11	5.01	1.42	1.03	36.15	57.07	3.37	3.42	.34	69
C336-3019.	725.	1170.	280.	.37	3.87	1.62	1.11	.31	.47	7.38	72.97	17.96	1.17	.29	70
C336-3019.7	725.	1190.	260.	1.36	3.62	1.53	1.17	.30	.45	7.07	77.01	14.84	.72	.31	71
C336-3029.	725.	1135.	315.	1.01	1.82	.55	.42	.06	0.00	2.85	76.78	18.48	1.57	.10	72
C336-3038.	750.	877.	573.	6.51	12.31	4.91	3.20	4.19	3.13	27.74	59.12	10.65	2.48	.42	73
C336-3049.	740.	703.	747.	.42	42.22	14.65	9.43	2.59	.81	69.70	28.00	.47	1.78	.64	74
C336-3054.	745.	846.	604.	.56	37.50	11.20	9.30	0.00	0.00	58.00	39.60	.53	1.84	.80	75
C336-3069.	1470.	743.	707.	9.65	36.62	9.10	6.02	1.74	.49	53.96	41.97	2.20	1.87	1.10	76
C336-3069.7	900.	890.	560.	4.19	27.33	6.52	3.31	1.04	.26	39.06	54.61	4.98	1.34	.74	77
C336-3074.	750.	766.	684.	1.94	46.81	12.65	8.51	2.11	.63	70.71	27.20	.40	1.64	.70	78
C336-3089.	1225.	983.	467.	2.53	27.14	7.99	4.97	1.41	1.46	42.96	51.85	.85	4.35	1.46	79
C336-3099.	850.	970.	480.	.59	33.73	15.90	11.10	3.53	0.00	64.26	33.24	.43	3.09	1.45	80
C336-3107.	975.	1071.	379.	.66	19.13	5.03	3.26	1.02	0.00	28.44	60.48	7.79	3.28	1.03	81
C336-3117.	740.	1149.	301.	2.65	1.10	.41	0.00	0.00	0.00	1.51	77.81	20.30	.33	.06	82
C336-3127.	700.	1055.	395.	3.09	5.59	1.73	.66	.10	0.00	8.08	78.48	7.36	6.08	.21	83
C336-3137.	730.	1083.	367.	4.37	6.43	.72	2.75	.14	0.00	10.04	74.90	11.78	3.29	.26	84
C336-3137.7	715.	1233.	267.	4.44	1.68	.53	.25	.04	0.00	2.50	78.82	15.61	3.07	.11	85
C336-3146.	775.	932.	518.	3.94	4.59	.91	1.11	.28	.07	6.92	79.43	1.17	12.51	.13	86
C336-3157.	725.	845.	605.	9.24	7.24	2.95	2.06	.43	.14	12.88	73.29	7.80	6.07	.17	87
C336-3166.	760.	1116.	334.	3.89	1.24	.24	.24	.02	0.00	1.78	78.44	19.15	.63	.06	88
C336-3176.	750.	788.	662.	4.72	2.39	.56	.68	.07	0.00	3.70	81.24	11.37	3.67	.04	89
C336-3186.	750.	971.	479.	5.07	11.04	2.43	1.94	.29	.06	15.76	71.98	9.89	2.36	.32	90
C336-3186.7	900.	1006.	444.	1.85	7.12	1.57	.73	.18	.06	9.66	78.30	9.16	2.88	.10	91

TABLE 3. (Continued)

INITIAL GAS RELEASE DATA: WELL C336

04/06/79

SAMPLE ID	PRESSURE TORR	FREE VOLUME CC	CORE VOLUME CC	POROSITY PCT.	METHANE	ETHANE	PROPANE	BUTANE	PENTANE	TOTAL HYDROC.	NITROGEN	OXYGEN	CARBON DIOXIDE	GAS RELEASED/ UNIT VOLUME OF SHALE	SEQ NO.
C336-3196.A	725.	311.	534.	3.60	.34	.20	.37	.02	0.00	.93	79.35	18.98	.47	.02	92
C336-3196.B	730.	1023.	327.	4.29	4.53	.43	1.98	.06	0.00	7.00	74.68	17.09	1.23	.16	93
C336-3206.	725.	852.	693.	5.01	2.47	.52	.64	.07	.01	3.71	82.54	13.52	.18	.05	94
C336-3216.	410.	931.	519.	9.70	7.31	1.45	.42	.16	.23	9.57	76.05	14.02	.36	.18	95
C336-3224.	1200.	465.	595.	2.87	27.07	7.92	4.57	1.18	.31	41.05	53.66	.75	4.54	.96	96
C336-3234.	750.	874.	576.	4.59	1.73	.39	.46	.02	0.00	2.60	80.09	15.69	1.61	.04	97
C336-3244.	720.	963.	437.	3.61	1.51	.39	.38	.02	0.00	2.30	79.20	14.54	3.93	.04	98
C336-3244.Z	745.	1066.	384.	4.63	.37	.17	.22	.01	0.00	.77	78.74	19.66	.84	.02	99
C336-3254.	240.	998.	452.	7.62	10.58	1.74	.82	.16	.02	13.26	74.21	10.64	1.87	.32	100
C336-3264.	330.	970.	480.	2.86	18.60	5.72	2.98	.70	.17	28.17	64.62	.91	6.27	.70	101
C336-3274.	760.	810.	640.	3.24	4.47	1.86	1.63	.32	.08	8.36	78.27	7.33	6.04	.11	102
C336-3284.	730.	578.	372.	5.43	3.01	1.72	1.19	.39	.13	6.44	80.91	5.86	6.75	.04	103
C336-3294.	780.	862.	508.	5.61	0.00	0.00	0.00	0.00	0.00	0.00	80.70	18.73	.57	0.00	104
C336-3304.	660.	857.	593.	4.44	1.81	.53	.42	.03	0.00	2.79	86.05	6.02	5.14	.03	105
C336-3304.Z	730.	1053.	397.	3.23	1.05	.21	.17	.02	0.00	1.45	89.26	6.56	2.73	.04	106
C336-3315.	725.	993.	547.	6.87	9.18	2.73	1.55	.41	.12	13.99	74.19	6.75	5.10	.22	108
C336-3325.	849.	977.	473.	5.23	20.13	5.30	3.68	1.68	.37	30.62	60.39	7.55	1.45	.70	109
C336-3335.	410.	386.	564.	3.91	19.94	3.33	2.45	.61	.16	17.49	74.03	1.14	7.37	.29	110
C336-3345.	750.	1018.	432.	4.27	4.98	1.72	1.28	.29	.08	8.35	79.70	9.72	2.27	.19	111
C336-3345.Z	760.	913.	467.	2.91	7.38	2.94	1.97	.42	.11	12.82	76.95	8.25	2.00	.13	112
C336-3355.	950.	512.	568.	4.44	20.58	6.54	3.99	1.14	.35	32.64	61.87	1.15	4.33	.63	113
C336-3365.	800.	578.	572.	2.31	24.61	8.75	6.28	1.65	.44	41.73	52.49	.82	4.93	.67	114
C336-3375.	845.	821.	629.	.62	36.03	11.85	7.57	1.86	.46	57.87	39.03	.50	2.56	.83	115
C336-3384.	1025.	893.	557.	1.69	18.35	4.64	2.10	.78	.22	26.59	61.81	11.09	.51	.57	116
C336-3394.	550.	931.	619.	1.22	30.81	10.02	6.53	1.41	.31	49.08	39.52	.63	2.63	.74	117
C336-3404.	850.	667.	743.	.83	21.50	6.08	2.89	.71	.21	31.39	62.51	1.63	4.45	.30	118
C336-3404.Z	746.	894.	556.	1.59	.16	.06	.18	0.00	0.00	.40	79.32	20.04	.24	.01	119

Column group heading over METHANE through OXYGEN: GAS COMPOSITION, VOLUME PERCENT

TABLE 4. STATISTICAL ANALYSES OF OFF GAS DATA

04/02/79

WELL C336

	MEAN	STANDARD DEVIATION	VARIANCE	COEFFICIENT OF DEVIATION	95 PCT. CONFIDENCE INTERVAL LOWER LIMIT	UPPER LIMIT	NO OF SAMPLES
METHANE, PERCENT	10.233	11.13	123.77	1.09	8.019	12.447	100
ETHANE, PERCENT	3.477	3.72	13.87	1.07	2.736	4.218	100
PROPANE, PERCENT	2.085	2.27	5.17	1.09	1.633	2.538	100
BUTANE, PERCENT	.592	.77	.59	1.30	.439	.744	100
PENTANE, PERCENT	.184	.42	.17	2.27	.101	.266	100
TOTAL HYDROCARBONS, PCT	16.571	17.47	305.11	1.05	13.095	20.047	100
NITROGEN, PERCENT	69.593	12.66	160.27	.18	67.074	72.113	100
OXYGEN, PERCENT	11.144	7.03	49.40	.63	9.745	12.543	100
CARBON DIOXIDE, PERCENT	2.747	2.37	5.61	.86	2.276	3.218	100
GAS VOLUME/SHALE VOLUME	.376	.42	.17	1.10	.293	.460	98

*I IS INSIGNIFICANT

TABLE 5. CHEMICAL CHARACTERIZATION DATA, 3778

SAMPLE ID	TOTAL, PERCENT CARBON	HYDROGEN	NITROGEN	LOW TEMPERATURE ASH, % 200 C	100 C	CARD CODE	SEQ NO.
C336-2444.	7.6	1.0	.1			5	2
C336-2454.	7.2	.9	.2			5	3
C336-2454.7	7.0	1.0	.2			5	4
C336-2464.	6.1	.8	.2			5	5
C336-2474.	6.1	.8	.2			5	6
C336-2494.	4.1	.6	.1			5	7
C336-2504.	4.9	.6	.1			5	8
C336-2514.	1.8	.6	.1			5	9
C336-2514.7	5.1	.7	.3			5	10
C336-2524.	1.5	.6	.2			5	11
C336-2534.	.8	.5	.1			5	12
C336-2545.	.7	.4	.1			5	13
C336-2555.	1.9	.4	.1			5	14
C336-2565.	3.9	.6	.1			5	15
C336-2565.7	1.6	.5	.1			5	16
C336-2575.	.5	.5	.1			5	17
C336-2586.	.5	.6	.1			5	18
C336-2588.	.4	.4	.1			5	19
C336-2595.	.7	.5	.1			5	20
C336-2607.	.9	.6	.1			5	21
C336-2617.	1.4	.5	.1			5	22
C336-2617.7	.5	.6	.1			5	23
C336-2637.	.5	.5	.1			5	24
C336-2646.	.5	.5	.1			5	25
C336-2656.	2.9	.6	.1			5	26
C336-2666.	2.9	.6	.2			5	27
C336-2666.7	4.0	.6	.1			5	28
C336-2676.	3.6	.7	.2			5	29
C336-2686.A	4.3	.7	.2			5	30
C336-2686.B	4.7	.7	.1			5	31
C336-2696.	4.4	.7	.1			5	32
C336-2705.	3.8	.7	.1			5	33
C336-2715.	2.5	.6	.1			5	34
C336-2725.	3.2	.7	.2			5	35
C336-2725.7	2.1	.6	.1			5	36
C336-2735.	3.4	.6	.1				37
C336-2745.	2.0	.6	.1			[illegible]	38
C336-2755.	2.0	.6	.1			[illegible]	39
C336-2763.	2.1	.6	.1			5	40
C336-2773.	3.2	.6	.1			5	41
C336-2784.	4.0	.7	.2			5	42
C336-2784.7	3.1	.7	.2			5	43
C336-2793.	.5	.6	.1			5	44
C336-2802.	1.0	.5	.1			5	45
C336-2814.	1.6	.6	.1			5	46
C336-2822.	.9	.6	.2			5	47

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TABLE 5. (Continued)
CHEMICAL CHARACTERIZATION DATA, 3778

SAMPLE ID	TOTAL, PERCENT CARBON	HYDROGEN	NITROGEN	LOW TEMPERATURE ASH, % 200 C	100 C	CARD CODE	SEQ NO.
C336-2830.	.6	.6	.1			5	48
C336-2842.	2.0	.7	.2			5	49
C336-2842.7	.8	.6	.1			5	50
C336-2852.	3.7	.7	.1			5	51
C336-2862.	2.4	.6	.1			5	52
C336-2872.	2.5	.7	.2			5	53
C336-2881.	1.9	.6	.1			5	54
C336-2891.	.5	.5	.1			5	55
C336-2901.	1.9	.6	.2			5	56
C336-2901.7	.5	.5	.1			5	57
C336-2911.	3.4	.7	.2			5	58
C336-2921.	8.4	1.1	.3			5	59
C336-2931.	.6	.5	.2			5	60
C336-2940.	3.9	.7	.2			5	61
C336-2950.	1.1	.5	.1			5	62
C336-2960.	7.3	.9	.2			5	63
C336-2960.7	6.8	.9	.2			5	64
C336-2970.	5.0	.7	.2			5	65
C336-2980.	.6	.5	.1			5	66
C336-2990.	5.8	.8	.2			5	67
C336-2999.	1.3	.4	.1			5	68
C336-3009.	4.3	.5	.2			5	69
C336-3019.	3.8	.7	.1			5	70
C336-3019.7	2.6	.6	.1			5	71
C336-3029.	.6	.4	.1			5	72
C336-3038.	5.9	.9	.1			5	73
C336-3049.	5.8	.9	.2			5	74
C336-3054.	3.8	.7	.2			5	75
C336-3069.	5.3	.8	.2			5	76
C336-3069.7	2.8	.5	.1			5	77
C336-3079.	4.6	.7	.1			5	78
C336-3089.	5.3	1.6	.2			5	79
C336-3099.	7.1	.9	.2			5	80
C336-3107.	5.0	.7	.2			5	81
C336-3117.	.9	.5	.1			5	82

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TABLE 5. (Continued)

CHEMICAL CHARACTERIZATION DATA, 3/78

SAMPLE ID	TOTAL, PERCENT CARBON	HYDROGEN	NITROGEN	LOW TEMPERATURE ASH, % 200 C	100 C	CARD CODE	SEQ NO.
C336-3157.	.3	.5	.1			5	87
C336-3176.	.5	.5	.1			5	89
C336-3186.	2.3	.7	.2			5	90
C336-3186.7	2.0	.6	.1			5	91
C336-3196.3	.3	.5	.1			5	92
C336-3196.8	.6	.5	.1			5	93
C336-3216.	.9	.5	.1			5	95
C336-3226.	2.4	.6	.2			5	96
C336-3234.	2.8	.7	.2			5	97
C336-3244.	1.5	.4	.1			5	98
C336-3254.	1.1	.5	.1			5	100
C336-3294.	.5	.4	.1			5	104
C336-3325.	2.5	.6	.1			5	109
C336-3345.7	.7	.5	.1			5	112
C336-3355.	2.0	.6	.1			5	113
C336-3365.	1.9	.5	.1			5	114
C336-3375.	5.8	.9	.2			5	115
C336-3384.	4.3	.7	.2			5	116
C336-3394.	2.7	.6	.2			5	117
C336-3404.	8.4	.2	.1			5	118
C336-3404.7	1.3	.1	.1			5	119

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TABLE 6. SUMMARY OF PHYSICAL CHARACTERIZATION DATA

	BULK DENSITY G/CC	OPEN PORSTY PCT	CLOSED PORSTY PCT	TOTAL POROSITY PCT	SURFACE AREA M2/G	SEQ
C336-2434.	2.505	.505	0.000	.505	.990	1
C336-2444.	2.482	.596	.515	1.111	1.010	2
C336-2454.	2.463	.847	1.731	2.578	3.490	3
C336-2454.2	2.494	.545	2.122	2.667	6.100	4
C336-2464.	2.496	.284	0.000	.284	.560	5
C336-2474.	2.575	.290	0.000	.290	.890	6
C336-2494.	2.575	1.181	.569	1.750	3.820	7
C336-2504.	2.554	.690	0.000	.690	2.830	8
C336-2514.	2.715	1.121	0.000	1.121	4.690	9
C336-2514.2	2.583	.707	6.002	6.709	4.700	10
C336-2524.	2.690	2.304	2.232	4.537	3.500	11
C336-2534.	2.777	1.919	0.000	1.919	2.680	12
C336-2545.	2.734	2.795	0.000	2.795	4.290	13
C336-2555.	2.891	1.855	0.000	1.855	4.070	14
C336-2565.	2.669	.604	2.077	2.681	.970	15
C336-2565.2	2.727	1.624	3.561	5.185	1.910	16
C336-2575.	2.709	2.217	0.000	2.217	.880	17
C336-2586.	2.728	1.688	0.000	1.688	4.820	18
C336-2588.	2.766	2.271	0.000	2.271	3.820	19
C336-2595.	2.730	1.736	0.000	1.736	.590	20
C336-2607.	2.720	2.209	1.417	3.626	1.080	21
C336-2617.	2.889	1.774	0.000	1.774	4.310	22
C336-2617.2	2.717	2.168	2.567	4.736	1.240	23
C336-2637.	2.718	1.966	0.000	1.966	3.910	24
C336-2646.	2.699	2.171	0.000	2.171	2.660	25
C336-2656.	2.650	.543	6.488	7.031	1.260	26
C336-2666.	2.695	.910	2.263	3.173	1.090	27
1336-2666.2	2.603	.471	0.000	.471	.660	28
C336-2676.	2.630	.419	3.779	4.198	3.430	29
C336-2696.	2.571	.350	.956	1.306	1.450	32
C336-2705.	2.597	.431	5.420	5.851	2.940	33
C336-2715.	2.666	.655	0.000	.655	4.220	34
C336-2725.	2.641	.616	0.000	.616	1.150	35
C336-2745.	2.675	.661	0.000	.661	.990	38
C336-2755.	2.664	.505	6.215	6.721	3.880	39
C336-2765.	2.674	.769	0.000	.769	3.200	40
C336-2775.	2.620	.841	0.000	.841	5.690	41
C336-2784.2	2.642	.732	0.000	.732	4.040	43
C336-2814.	2.714	.654	0.000	.654	1.010	46
C336-2830.	2.717	1.512	0.000	1.512	1.000	48
C336-2842.	2.680	1.049	0.000	1.049	4.130	49
C336-2842.2	2.763	2.063	0.000	2.063	.810	50
C336-2852.	2.606	.947	1.278	2.225	4.150	51
C336-2881.	2.679	1.144	0.000	1.144	4.540	54

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TABLE 6. (Continued)
SUMMARY OF PHYSICAL CHARACTERIZATION DATA

	BULK DENSITY G/CC	OPEN PORSTY PCT	CLOSED PORSTY PCT	TOTAL POROSITY PCT	SURFACE AREA M2/G	SEQ
C556-2891.	2.742	1.685	0.000	1.685	1.010	55
C556-2901.	2.707	.762	0.000	.762	3.360	56
C556-2901.2	2.729	1.590	2.586	4.176	4.020	57
C556-2911.	2.628	.514	0.000	.514	1.060	58
C556-2921.	2.455	.240	0.000	.240	.530	59
C556-2931.	2.731	1.474	0.000	1.474	1.520	60
C556-2940.	2.613	.718	2.274	2.993	1.060	61
C556-2960.	2.460	.674	.005	.679	3.390	63
C556-2960.2	3.429	.620	0.000	.620	3.060	64
C556-2970.	2.556	.356	0.000	.356	1.030	65
C556-2980.	2.710	2.242	0.000	2.242	3.730	66
C556-2990.	2.584	.453	0.000	.453	3.750	67
C556-2999.	2.741	2.118	1.317	3.435	4.250	68
C556-3019.	2.520	.370	0.000	.370	DATA INCOMPLETE	70
C556-3019.2	2.680	1.364	0.000	1.364	.950	71
C556-3029.	2.739	1.812	0.000	1.812	2.020	72
C556-3038.	2.510	.987	5.524	6.511	4.100	73
C556-3049.	2.533	.417	0.000	.417	1.520	74
C556-3054.	2.545	.561	0.000	.561	1.330	75
C556-3069.	2.519	.628	9.020	9.648	3.610	76
C556-3069.2	2.608	.987	3.110	4.097	4.770	77
C556-3089.	2.567	.484	2.047	2.530	.790	79
C556-3099.	2.568	.585	0.000	.585	1.020	80
C556-3107.	2.580	.655	0.000	.655	2.240	81
C556-3117.	2.684	2.645	0.000	2.645	1.650	82
C556-3127.	2.695	3.091	0.000	3.091	2.660	83
C556-3137.	2.677	4.027	.341	4.368	2.500	84
C556-3137.2	2.680	4.437	0.000	4.437	3.020	85
C556-3146.	2.694	3.938	0.000	3.938	2.040	86
C556-3157.	2.666	3.521	5.718	9.240	3.080	87
C556-3166.	2.674	3.691	0.000	3.691	1.430	88
C556-3176.	2.724	3.171	1.549	4.720	3.360	89
C556-3186.	2.613	4.099	.970	5.069	4.070	90
C556-3196.A	2.672	3.678	0.000	3.678	2.450	92
C556-3196.B	2.665	4.291	0.000	4.291	2.080	93
C556-3206.	2.650	5.006	0.000	5.006	1.070	94
C556-3216.	2.660	3.892	5.812	9.704	4.420	95
C556-3224.	2.627	2.865	0.000	2.865	3.440	96
C556-3234.	2.684	4.591	0.000	4.591	3.210	97
C556-3244.	2.789	3.630	0.000	3.630	2.720	98
C556-3244.2	2.690	4.631	0.000	4.631	2.020	99
C556-3254.	2.647	4.525	3.099	7.624	3.590	100
C556-3264.	2.654	2.860	0.000	2.860	2.660	101
C556-3274.	2.618	3.175	.067	3.243	2.660	102
C556-3284.	2.728	4.037	1.392	5.429	1.460	103

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TABLE 6. (Continued)
SUMMARY OF PHYSICAL CHARACTERIZATION DATA

	BULK DENSITY G/CC	OPEN PORSTY PCT	CLOSED PORSTY PCT	TOTAL POROSITY PCT	SURFACE AREA M2/G	SEQ
C336-3294.	2.653	5.612	0.000	5.612	4.630	104
C336-3304.	2.700	4.439	0.000	4.439	1.030	105
C336-3304.Z	2.711	3.229	0.000	3.229	2.470	106
C336-3315.	2.713	3.076	3.793	6.869	1.670	108
C336-3325.	2.552	2.546	2.680	5.226	6.860	109
C336-3335.	2.674	3.908	0.000	3.908	2.300	110
C336-3345.	2.671	4.270	0.000	4.270	3.420	111
C336-3355.	2.654	3.917	.522	4.439	.770	113
C336-3365.	2.673	1.510	.801	2.310	1.700	114
C336-3375.	2.496	.617	0.000	.617	.660	115
C336-3384.	2.522	.732	.954	1.685	1.160	116
C336-3394.	2.596	1.224	0.000	1.224	.610	117
C336-3404.	2.685	.830	0.000	.830	1.010	118
C336-3404.Z	2.763	.650	.933	1.584	1.450	119

TABLE 7. STATISTISTICAL ANALYSES OF PHYSICAL CHARACTERIZATION DATA

WELL C-336

	MEAN	STANDARD DEVIATION	VARIENCE	COEFFICIENT OF DEVIATION	95 PCT. CONFIDENCE INTERVAL LOWER LIMIT	UPPER LIMIT	NO OF SAMPLES
BULK DENSITY, G/CC	2.659	.11	.01	.04	2.636	2.681	103
APPARENT DENSITY, G/CC	2.710	.13	.02	.05	2.684	2.736	103
TRUE DENSITY, G/CC	2.584	.34	.12	.13	2.517	2.651	103
OPEN POROSITY, PCT	1.850	1.41	2.00	.76	1.574	2.127	103
CLOSED POROSITY, PCT	1.007	1.85	3.41	1.83	.646	1.366	103
TOTAL POROSITY, PCT	2.857	2.20	4.83	.77	2.426	3.287	103
WEIGHT LOSS INITIAL, G/KG	10.466	3.11	9.69	.30	9.857	11.074	103
WEIGHT LOSS FINAL, G/KG	-.917	6.69	44.73	-7.29	0.000	.390	103
TOTAL WEIGHT LOSS, G/KG	9.549	7.01	49.19	.73	8.177	10.920	103
SURFACE AREA, M2/G	2.539	1.49	2.22	.59	2.246	2.831	102

*I IS INSIGNIFICANT

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TABLE 8. POROSITY DATA FROM DENSITIES

SAMPLE ID.	TOTAL POROSITY, PCT.
C336-2434.	.51
C336-2444.	.60
C336-2454.	.85
C336-2454.Z	.55
C336-2464.	.28
C336-2474.	.29
C336-2494.	1.18
C336-2504.	.69
C336-2514.	1.12
C336-2514.Z	.71
C336-2524.	2.30
C336-2534.	1.92
C336-2545.	2.80
C336-2555.	1.86
C336-2565.	.60
C336-2565.Z	1.62
C336-2575.	2.22
C336-2586.	1.69
C336-2588.	2.27
C336-2595.	1.74
C336-2607.	2.21
C336-2617.	1.77
C336-2617.Z	2.17
C336-2637.	1.97
C336-2646.	2.17
C336-2656.	.54
C336-2666.	.91
C336-2666.Z	.47
C336-2676.	.42
C336-2696.	.35
C336-2705.	.43
C336-2715.	.66
C336-2725.	.62
C336-2745.	.66
C336-2755.	.51
C336-2763.	.77
C336-2773.	.84
C336-2784.Z	.73
C336-2814.	.85
C336-2830.	1.51
C336-2842.	1.05
C336-2842.Z	2.06
C336-2852.	.95
C336-2881.	1.14

TABLE 8. (Continued)

SAMPLE ID,	TOTAL POROSITY, PCT,
C336-2891.	1.69
C336-2901.	.76
C336-2901.Z	1.59
C336-2911.	.51
C336-2921.	.24
C336-2931.	1.47
C336-2940.	.72
C336-2960.	.67
C336-2960.Z	.82
C336-2970.	.36
C336-2980.	2.24
C336-2990.	.45
C336-2999.	2.12
C336-3019.	.37
C336-3019.Z	1.36
C336-3029.	1.81
C336-3038.	.99
C336-3049.	.42
C336-3054.	.56
C336-3069.	.63
C336-3069.Z	.99
C336-3089.	.48
C336-3099.	.59
C336-3107.	.66
C336-3117.	2.65
C336-3127.	3.09
C336-3137.	4.03
C336-3137.Z	4.44
C336-3146.	3.94
C336-3157.	3.52
C336-3166.	3.89
C336-3176.	3.17
C336-3186.	4.10
C336-3196.A	3.08
C336-3196.B	4.29
C336-3206.	5.01
C336-3216.	3.09
C336-3224.	2.87
C336-3234.	4.59
C336-3244.	3.63
C336-3244.Z	4.63
C336-3254.	4.53
C336-3264.	2.86
C336-3274.	3.18
C336-3284.	4.04

TABLE 8. (Continued)

SAMPLE ID.	TOTAL POROSITY, PCT.
C336-3294.	5.61
C336-3304.	4.44
C336-3304.Z	3.23
C336-3315.	3.08
C336-3325.	2.55
C336-3335.	3.91
C336-3345.	4.27
C336-3355.	3.92
C336-3365.	1.51
C336-3375.	.62
C336-3384.	.73
C336-3394.	1.22
C336-3404.	.83
C336-3404.Z	.65

TABLE 9. MERCURY INTRUSION POROSITIES FOR WELL C-336

SEQUENCE NUMBER	SAMPLE ID	POROSITY, %
1	2434	4.10
2	2444	6.40
3	2454	3.71
4	2454.Z	2.12
5	2463	4.24
6	2474	3.44
7	2494	4.24
8	2504	3.71
9	2514	6.10
10	2514.Z	4.50
11	2524	4.10
12	2534	4.10
13	2545	8.10
14	2555	4.24
15	2565	5.30
16	2565.Z	5.30
17	2575	4.50
18	2586	9.54
19	2588	5.10
20	2595	3.71
21	2607	4.10
22	2617	5.10
23	2617.Z	3.44
24	2637	3.44
25	2646	5.03
26	2656	5.30
27	2666	5.03
28	2666.Z	1.10
29	2676	3.01
30	2686.A	4.10
31	2686.B	2.65
32	2696	5.10
33	2705	5.10
34	2715	5.03
35	2725	10.10
36	2725.Z	6.10
37	2735	5.10
38	2745	3.01
39	2755	4.10
40	2763	5.03
41	2773	4.50

TABLE 9. (Continued)

43	2784.Z	3.20
44	2793	4.10
45	2802	8.21
46	2814	4.10
47	2822	2.65
48	2830	9.01
49	2842	4.10
50	2842.Z	5.03
51	2852	3.44
52	2862	6.41
53	2872	5.61
54	2881	9.80
55	2891	4.50
56	2901	5.03
57	2901.Z	5.10
58	2911	4.50
59	2921	4.10
60	2931	4.24
61	2940	5.30
62	2950	4.10
64	2960.Z	3.20
65	2970	4.24
66	2980	5.83
67	2990	5.03
68	2999	3.44
69	3009	4.10
70	3019	3.71
71	3019.Z	4.50
72	3029	6.62
73	3038	4.50
74	3049	7.71
75	3054	4.24
76	3069	3.71
77	3069.Z	3.20
78	3079	5.10
79	3089	4.10
80	3099	5.10
81	3107	4.10
82	3117	4.10
83	3127	4.10
84	3137	7.42

TABLE 9. (Continued)

85	3137.Z	9.80
86	3146	7.10
87	3157	6.41
88	3166	7.15
89	3176	10.91
90	3186	5.10
91	3186.Z	3.71
92	3196.A	5.30
93	3196.B	6.41
94	3206	5.10
95	3216	3.20
96	3224	7.10
97	3234	5.61
98	3244	5.61
99	3244.Z	7.15
100	3254	5.10
101	3264	3.01
102	3274	6.41
103	3284	6.62
104	3294	9.80
105	3304	5.83
106	3304.Z	9.01
108	3315	5.83
109	3325	5.10
110	3335	5.61
111	3345	5.31
112	3345.Z	7.42
113	3355	5.03
114	3365	4.24
115	3375	4.24
116	3384	2.65
117	3394	8.10
118	3404	3.01
119	3404.Z	7.15

TABLE 10. ENERGY DISPERSIVE ANALYSIS OF SHALES

	Element Count Per 100 Counts													
Shale Sample	Na	K	Ca	Mg	Al	Si	Fe	S	Ti	P	Fe/S	K/Al	K/Si	Al/Si
C-336-2524	-	12.4	-	2.0	21.0	52.0	10.7	-	1.9	-	∞	0.59	0.24	0.40
C-336-2646	-	8.1	-	2.0	26.4	59.7	3.3	-	0.5	-	∞	0.31	0.14	0.44
C-336-2763	-	7.7	2.8	Tr	19.9	60.8	5.0	2.8	1.0	-	1.8	0.39	0.13	0.33
C-336-2842ZC	-	10.8	-	1.8	24.4	56.3	4.6	0.9	1.2	-	5.0	0.44	0.19	0.43
C-336-2990	-	5.5	-	Tr	17.3	70.1	3.3	3.4	0.4	-	1.0	0.32	0.08	0.25
C-336-3186ZCB	-	7.1	7.4	Tr	20.4	51.7	6.1	6.3	1.1	-	1.0	0.35	0.14	0.39
C-336-3315	-	10.1	-	Tr	22.2	61.4	4.5	0.9	0.9	-	5.3	0.46	0.16	0.36

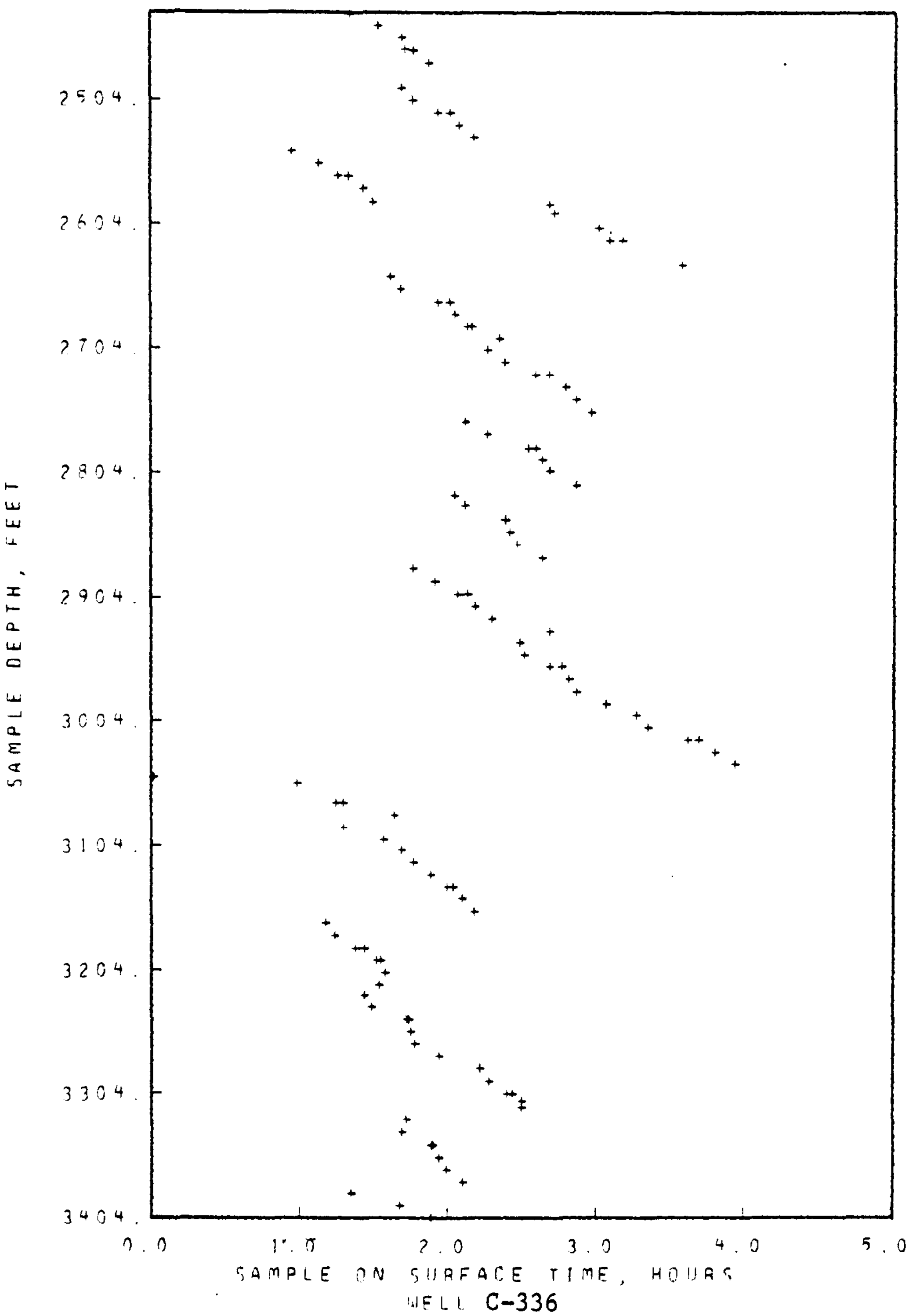


FIGURE 1. ON-SURFACE TIME FOR WELL C-336

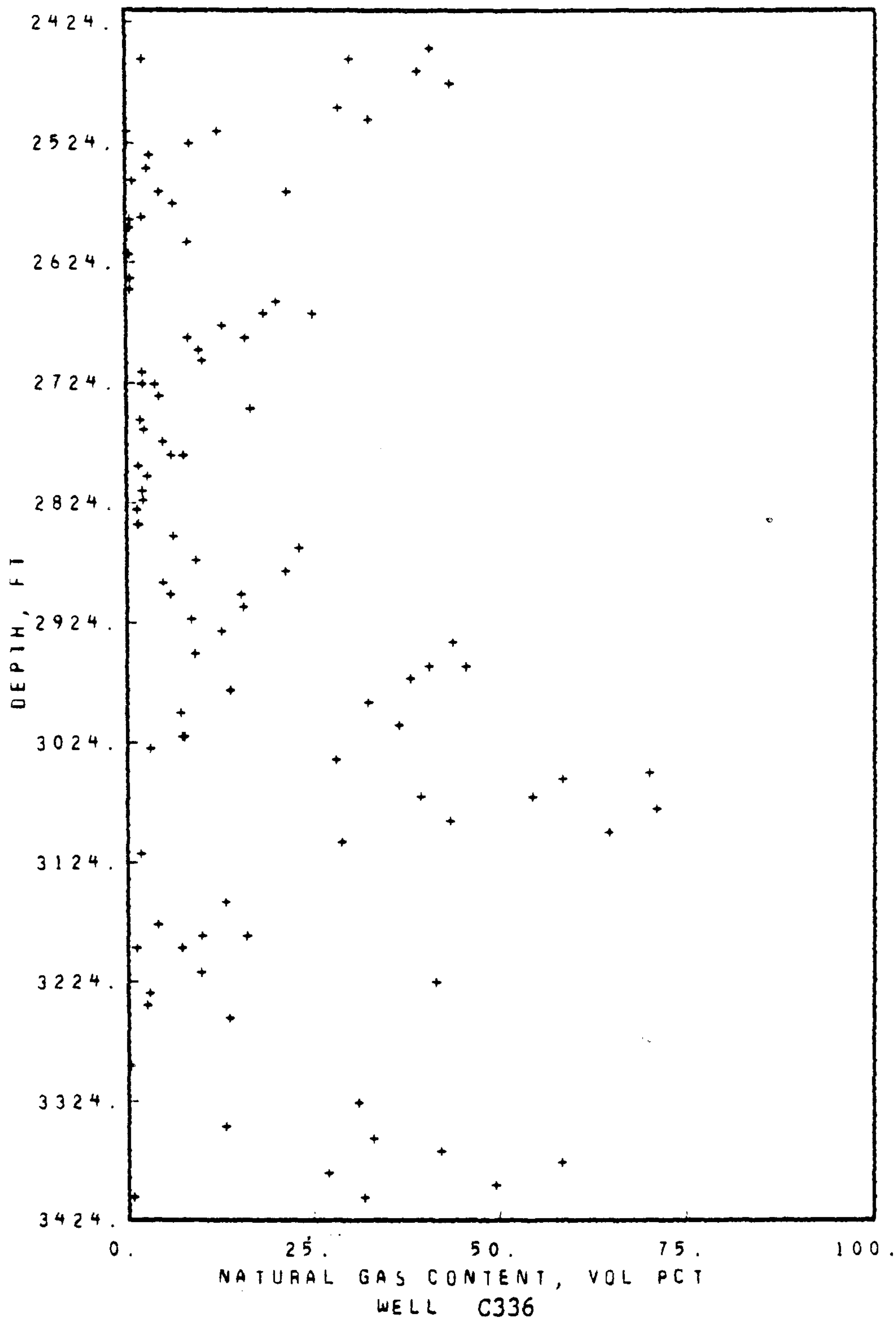


FIGURE 2. HYDROCARBON GAS VERSUS DEPTH FOR WELL C-336

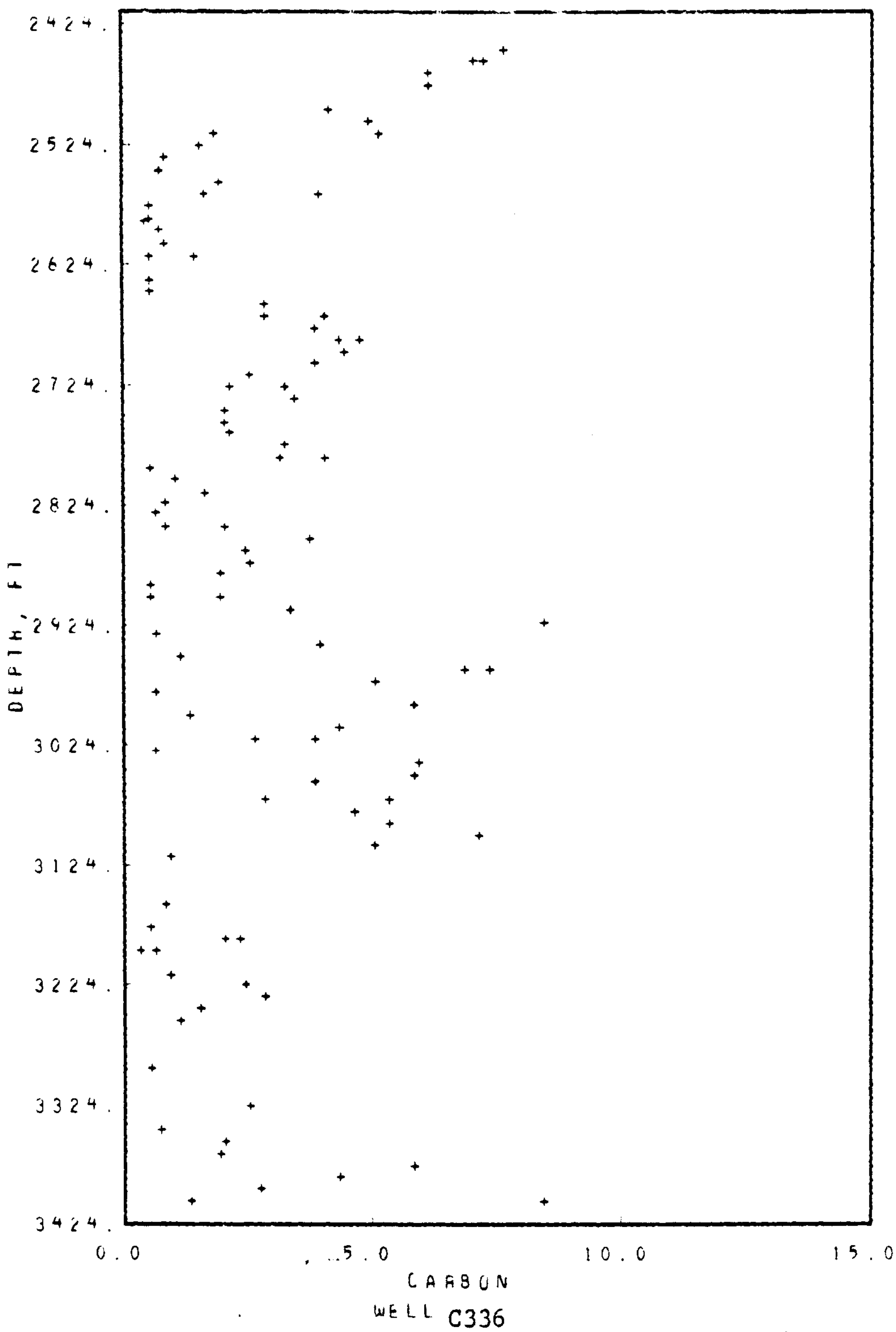


FIGURE 3. CARBON VERSUS DEPTH FOR WELL C-336

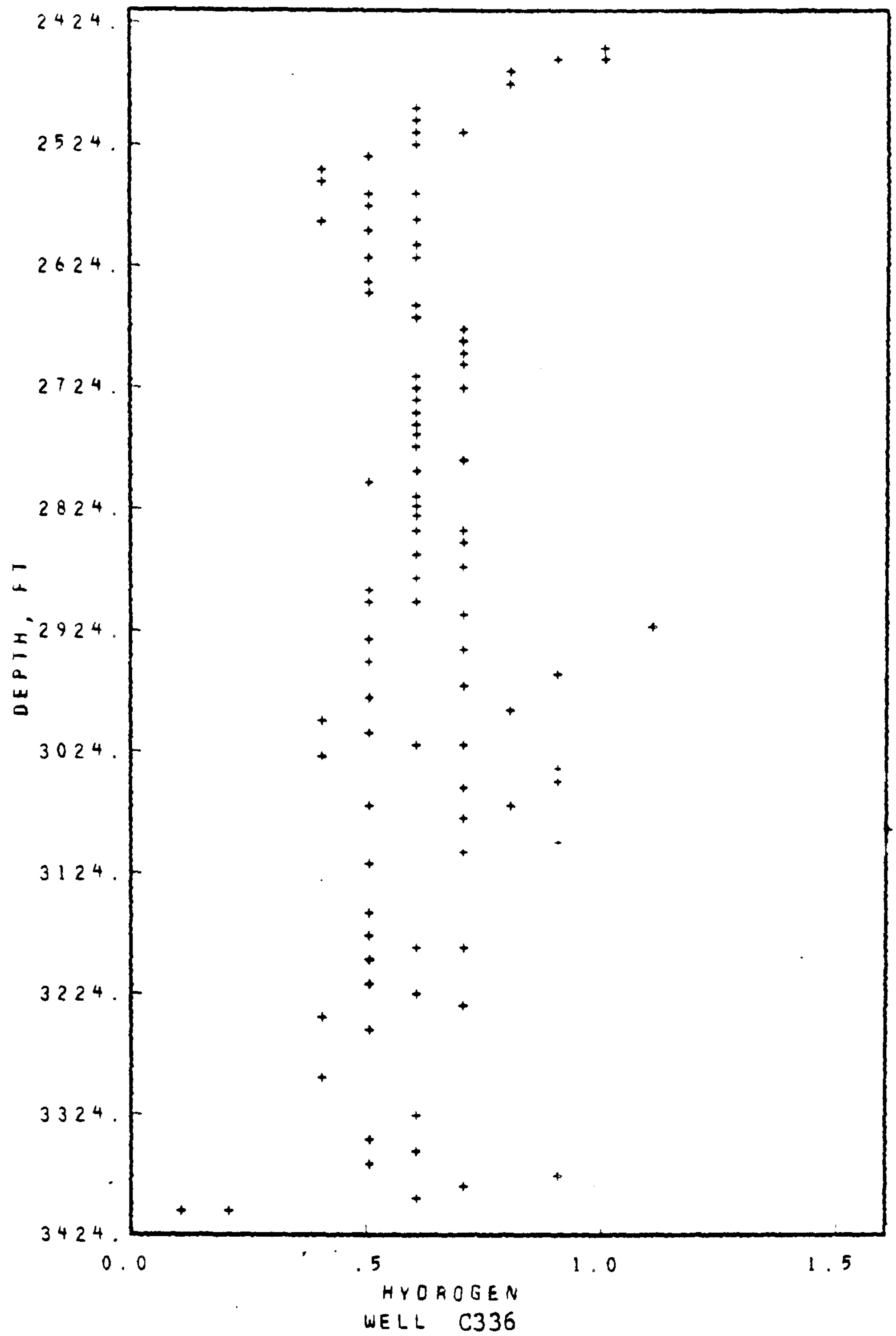


FIGURE 4. HYDROGEN VERSUS DEPTH FOR WELL C-336

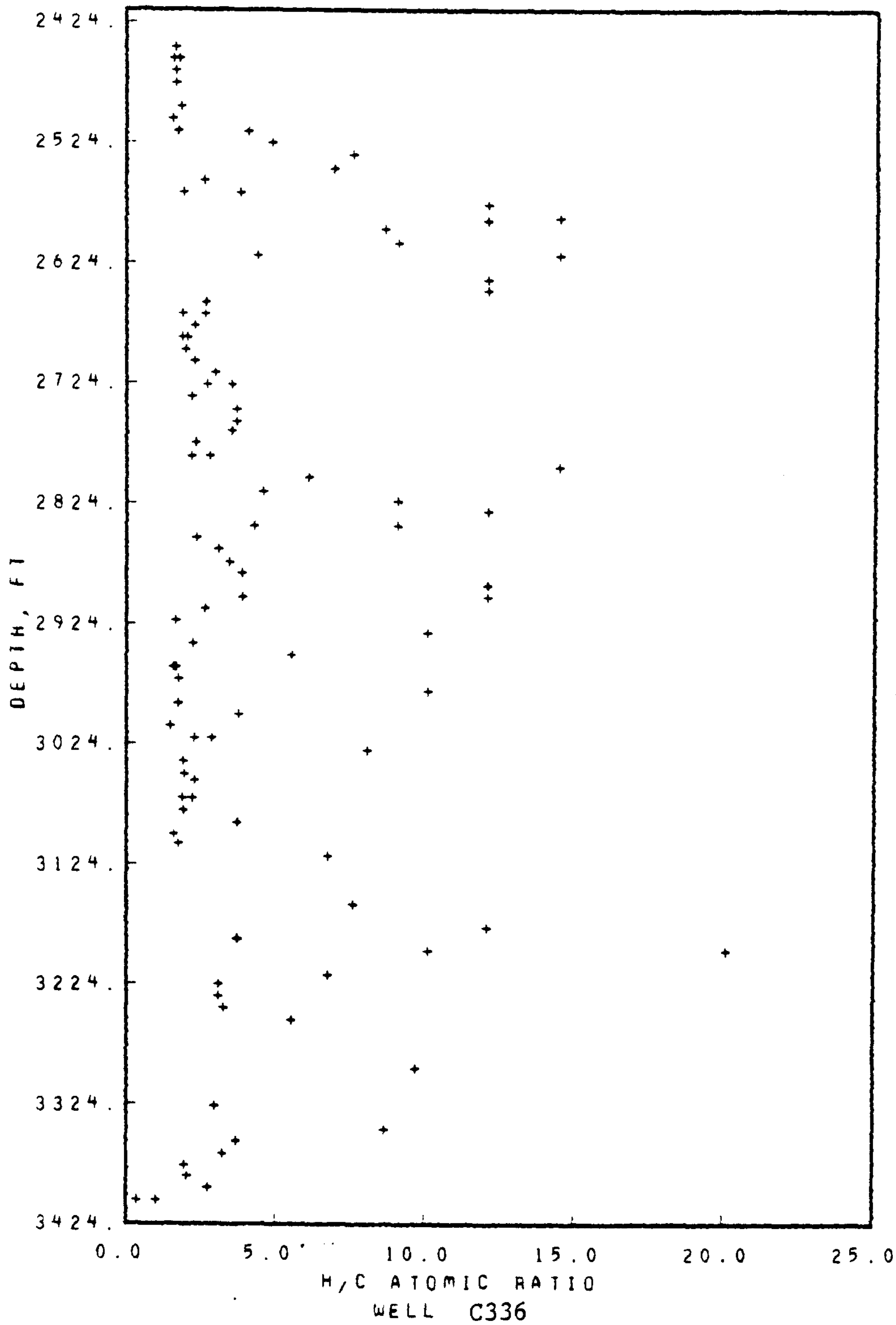


FIGURE 5. H/C ATOMIC RATIO VERSUS DEPTH FOR WELL C-336

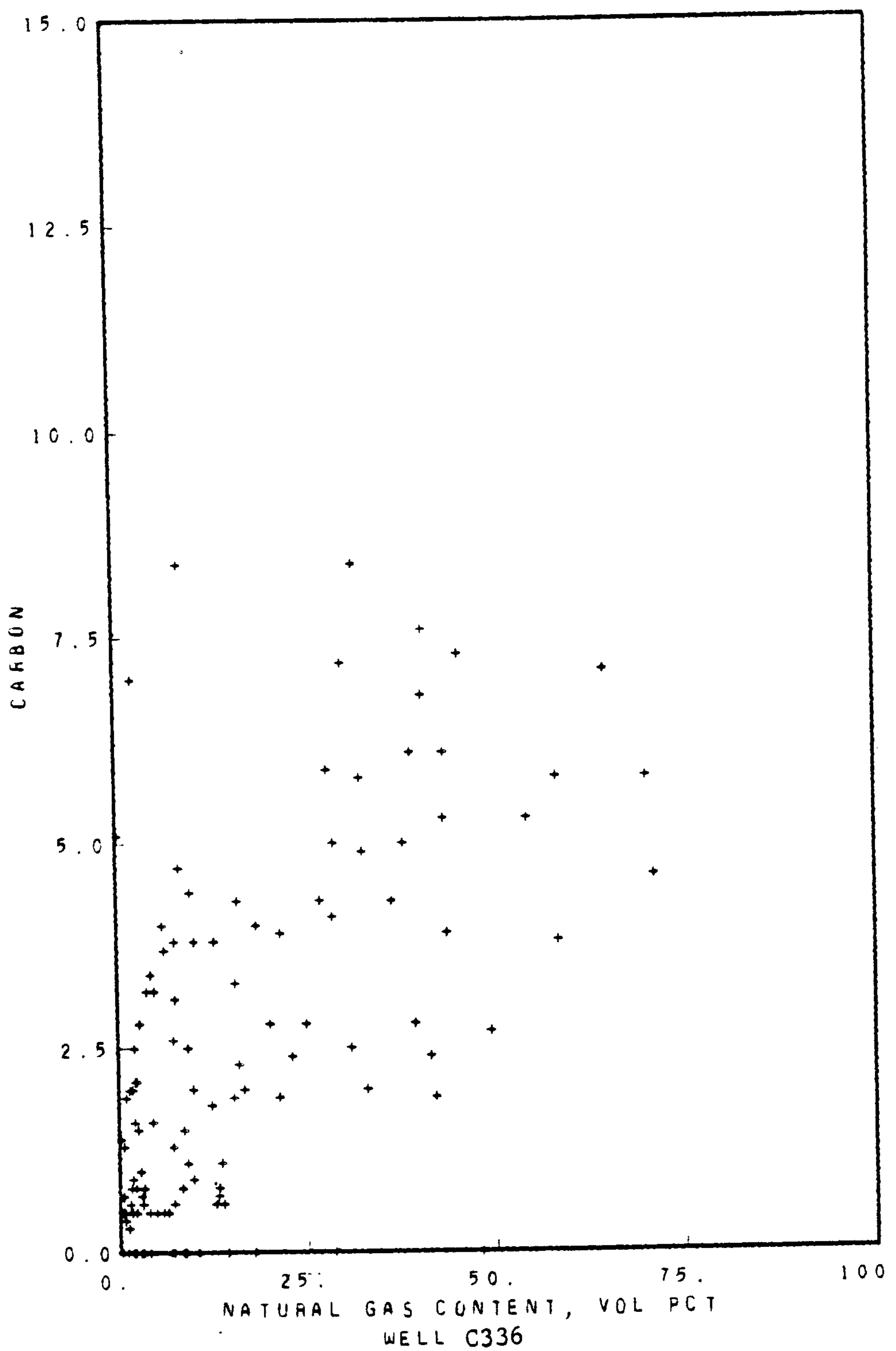


FIGURE 6. NATURAL GAS VERSUS CARBON FOR WELL C-336

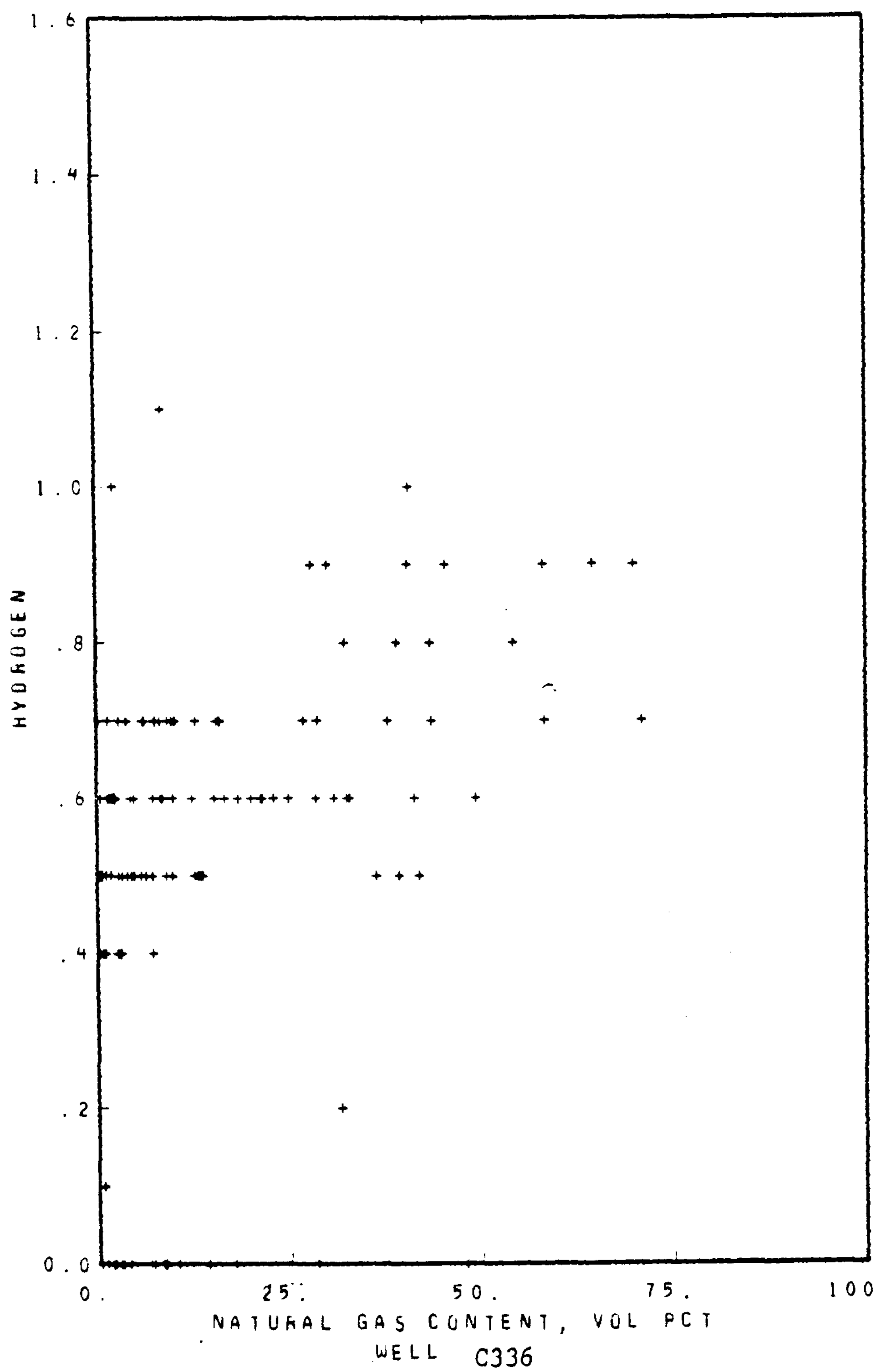


FIGURE 7. NATURAL GAS VERSUS HYDROGEN FOR WELL C-336

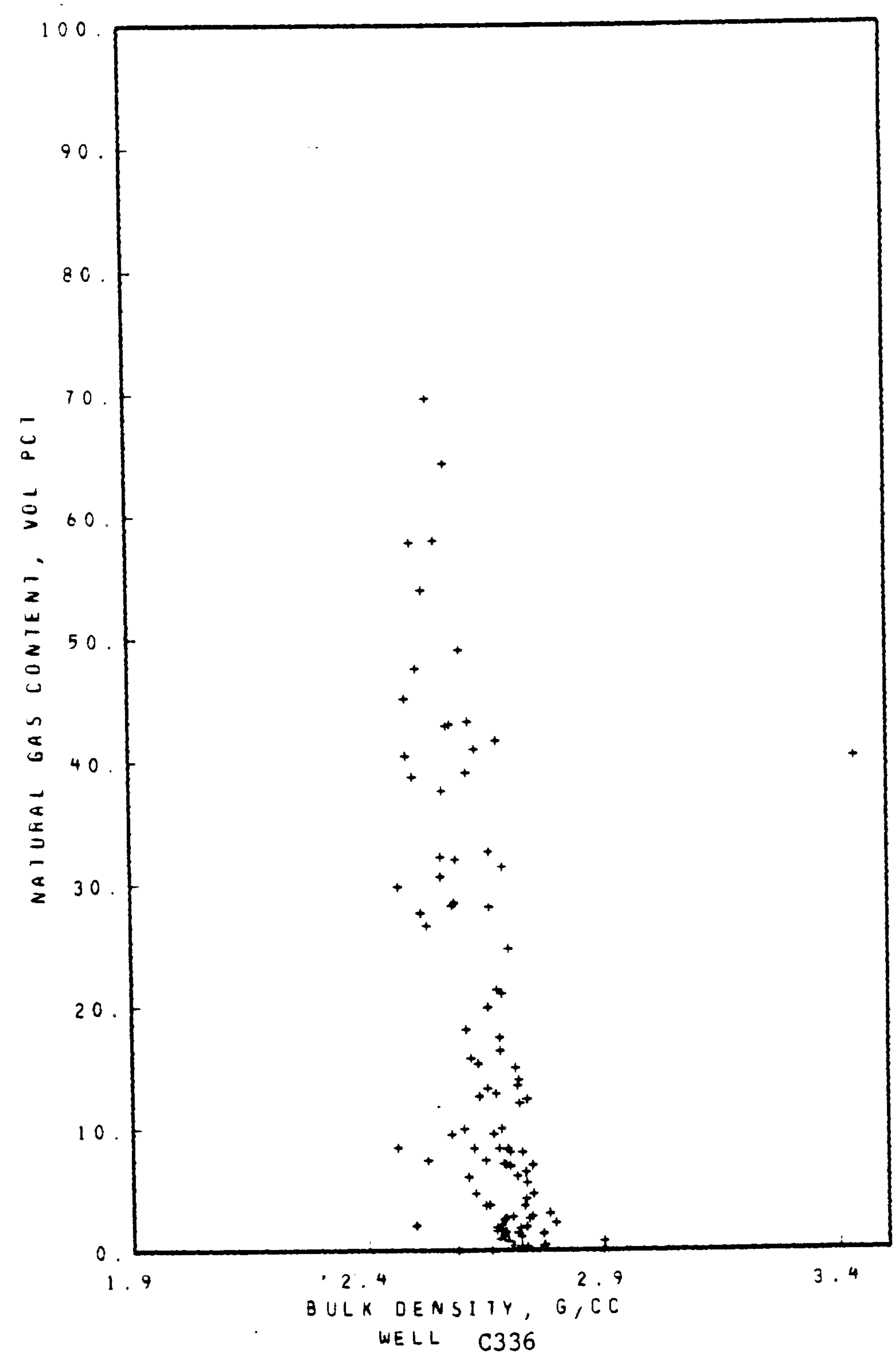


FIGURE 8. HYDROCARBON GAS VERSUS BULK DENSITY FOR WELL C-336

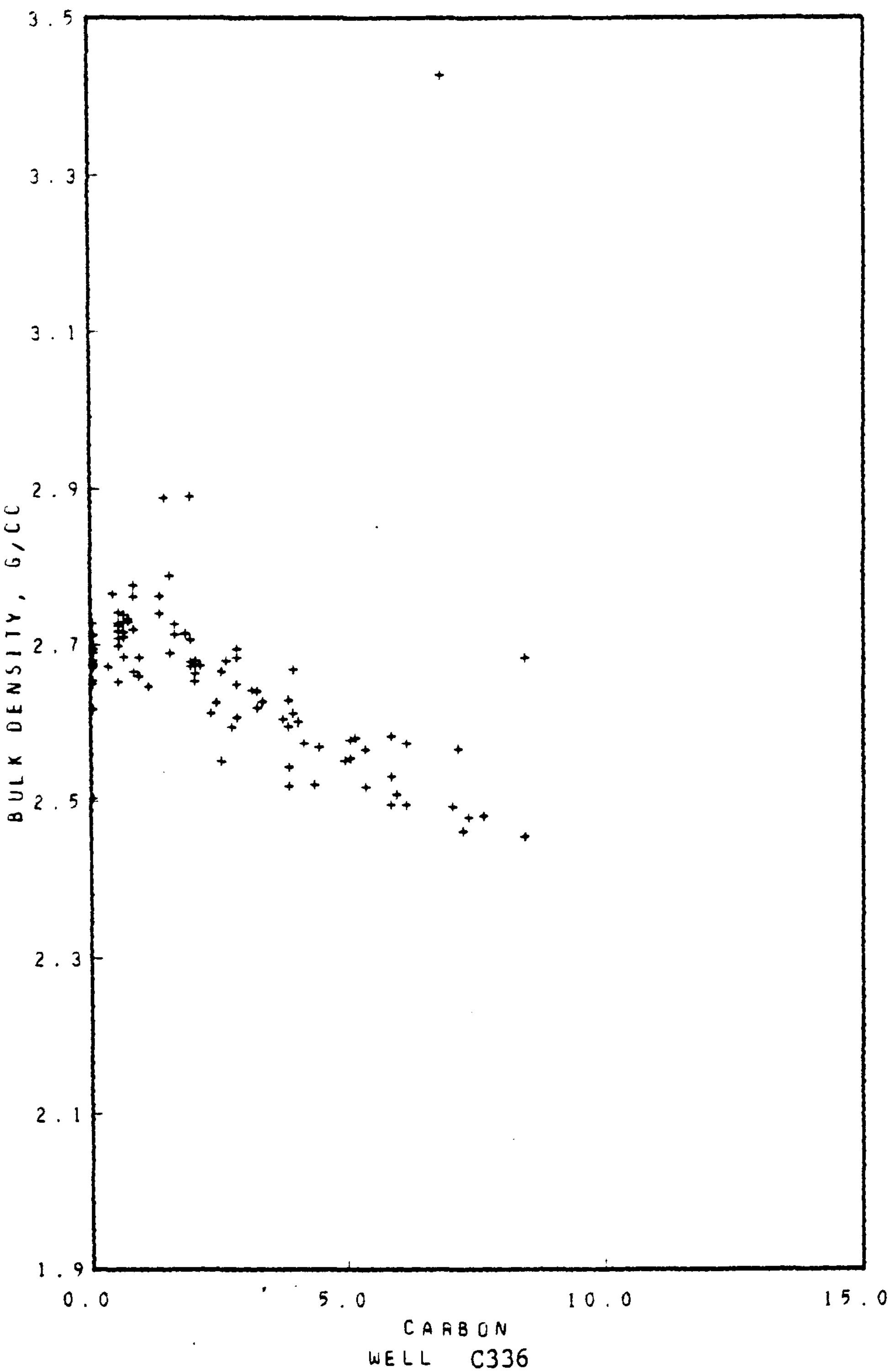


FIGURE 9. CARBON VERSUS BULK DENSITY FOR WELL C-336

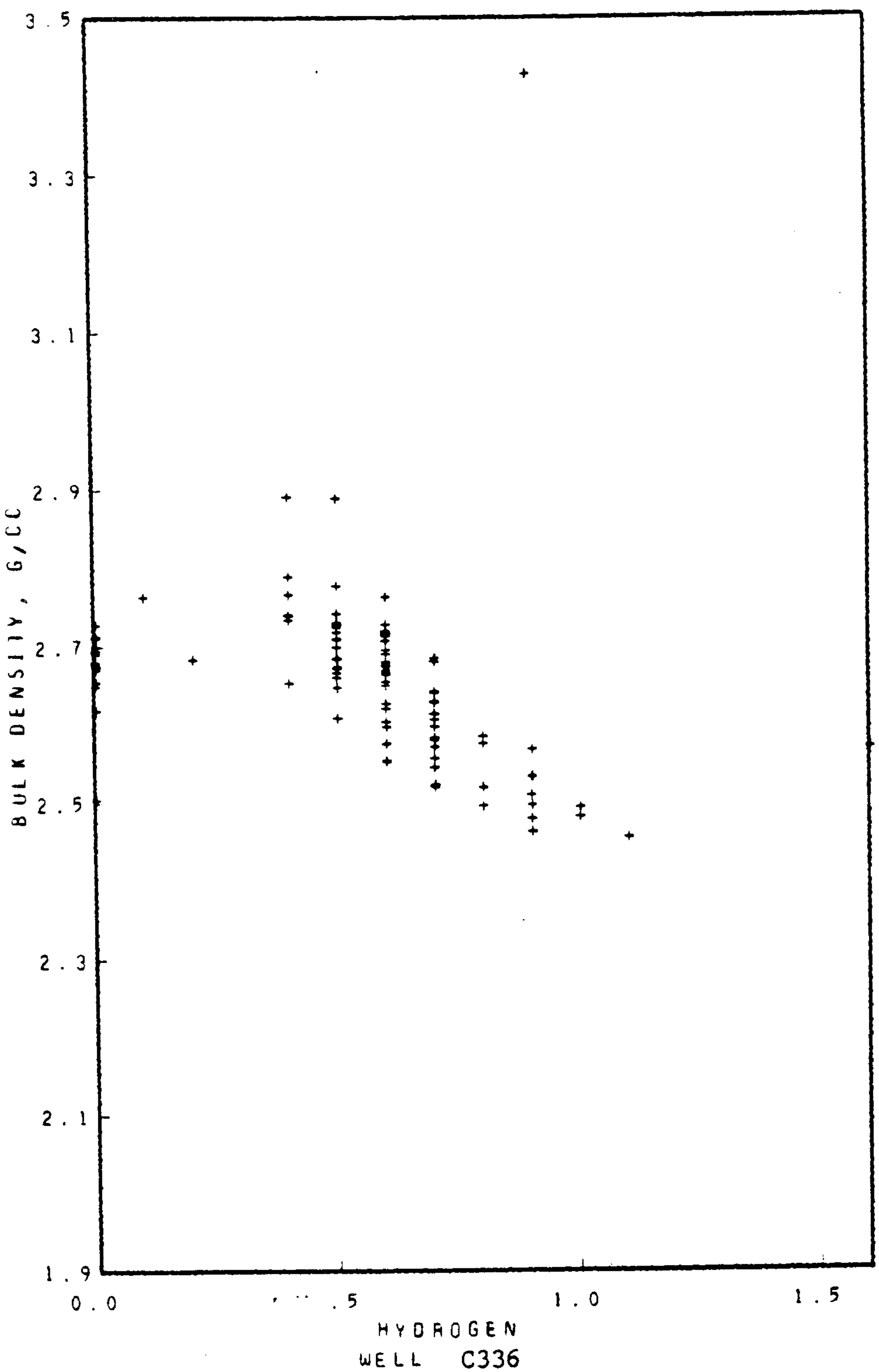


FIGURE 10. HYDROGEN VERSUS BULK DENSITY FOR WELL C-336

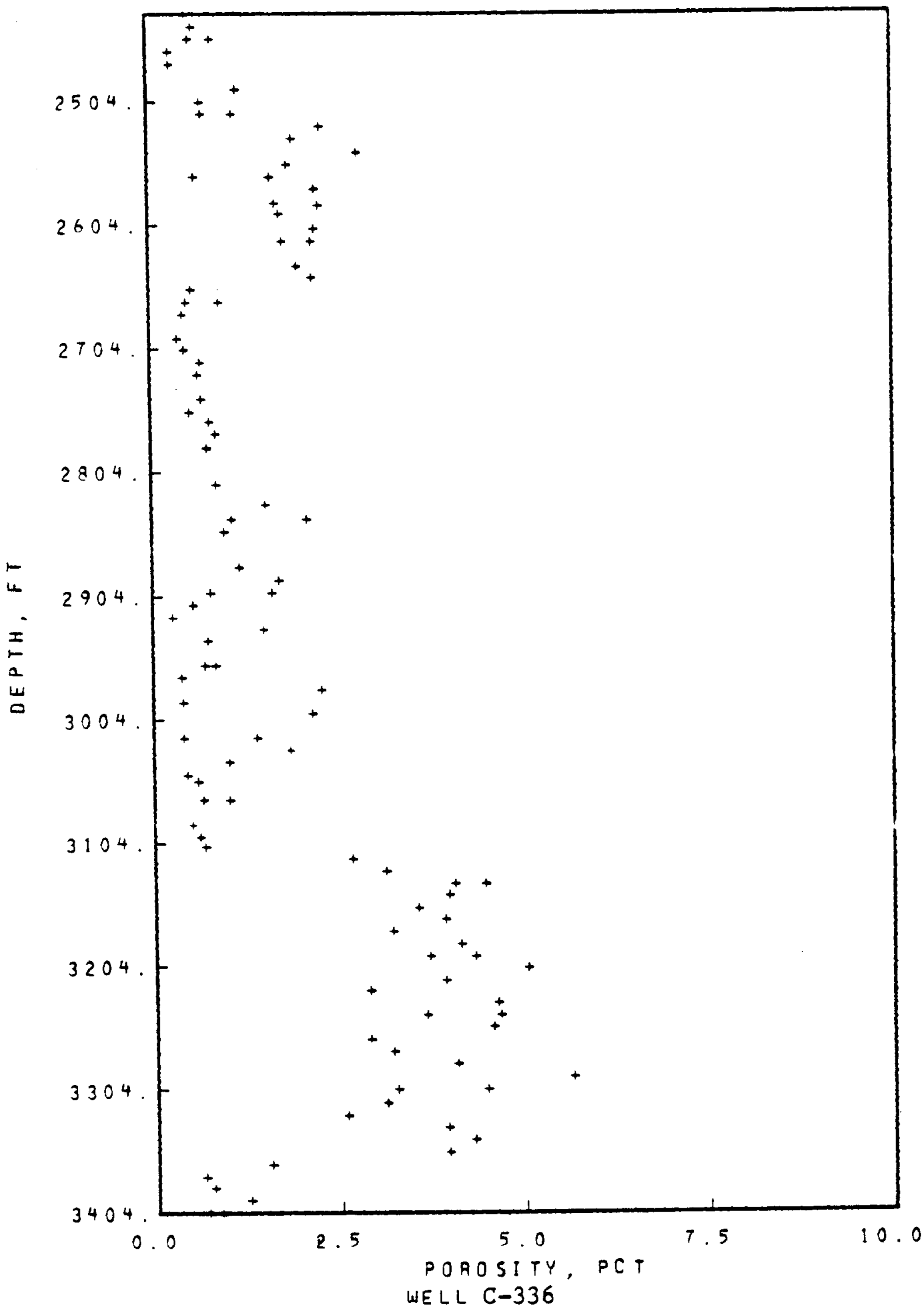


FIGURE 11. POROSITY VERSUS DEPTH FOR WELL C-336

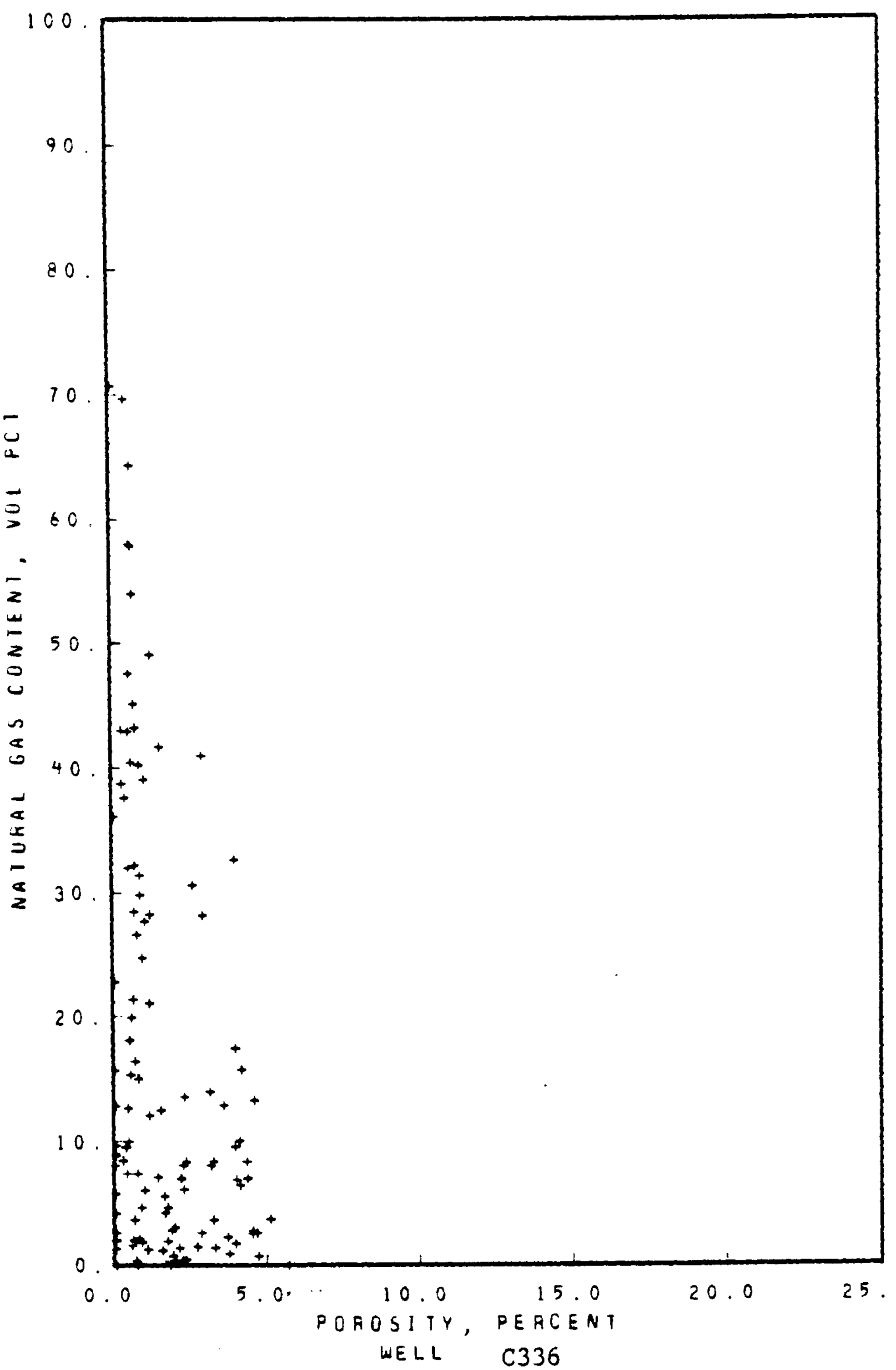


FIGURE 12. POROSITY VERSUS NATURAL GAS FOR WELL C-336

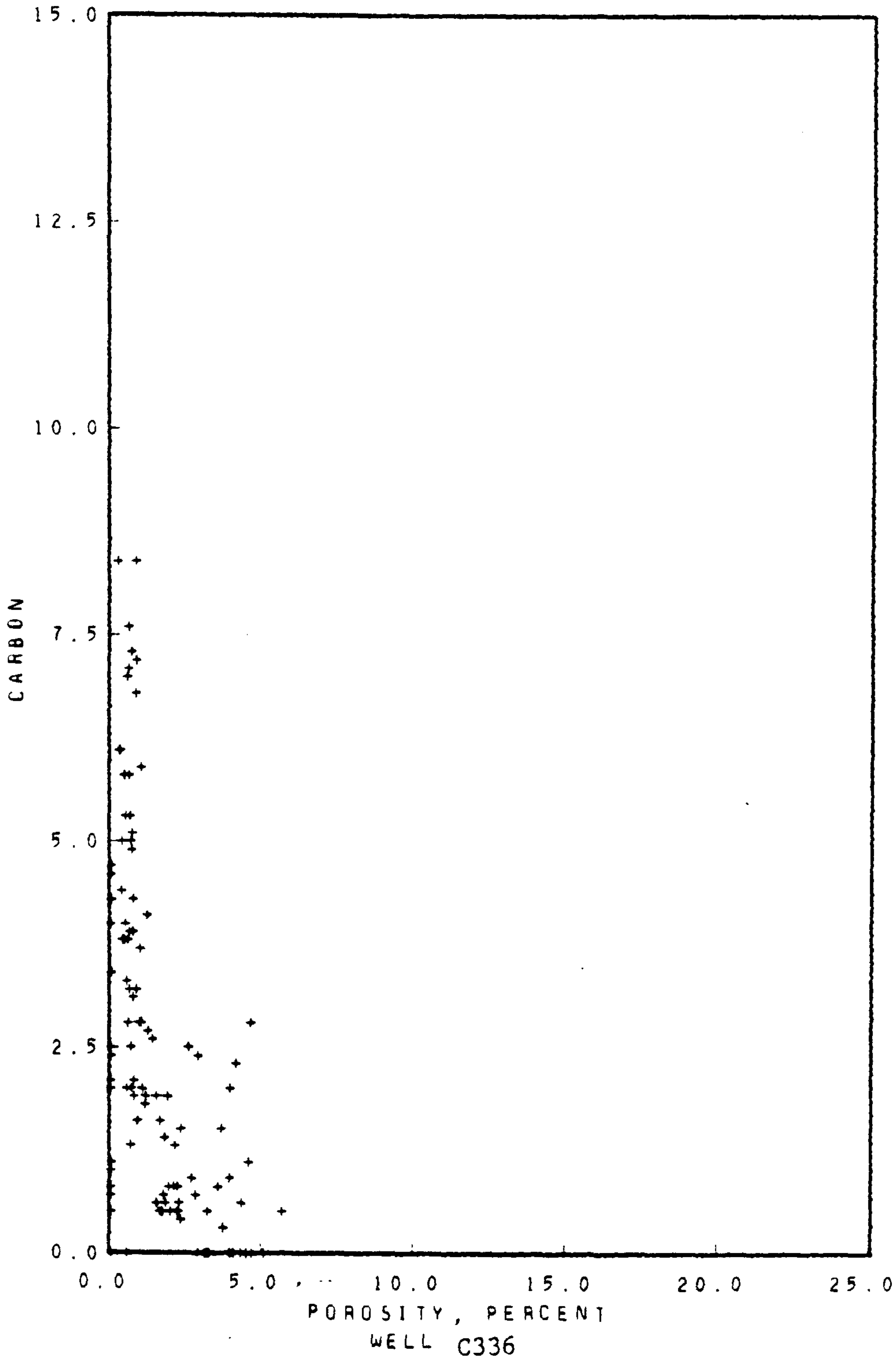


FIGURE 13. POROSITY VERSUS CARBON FOR WELL C-336

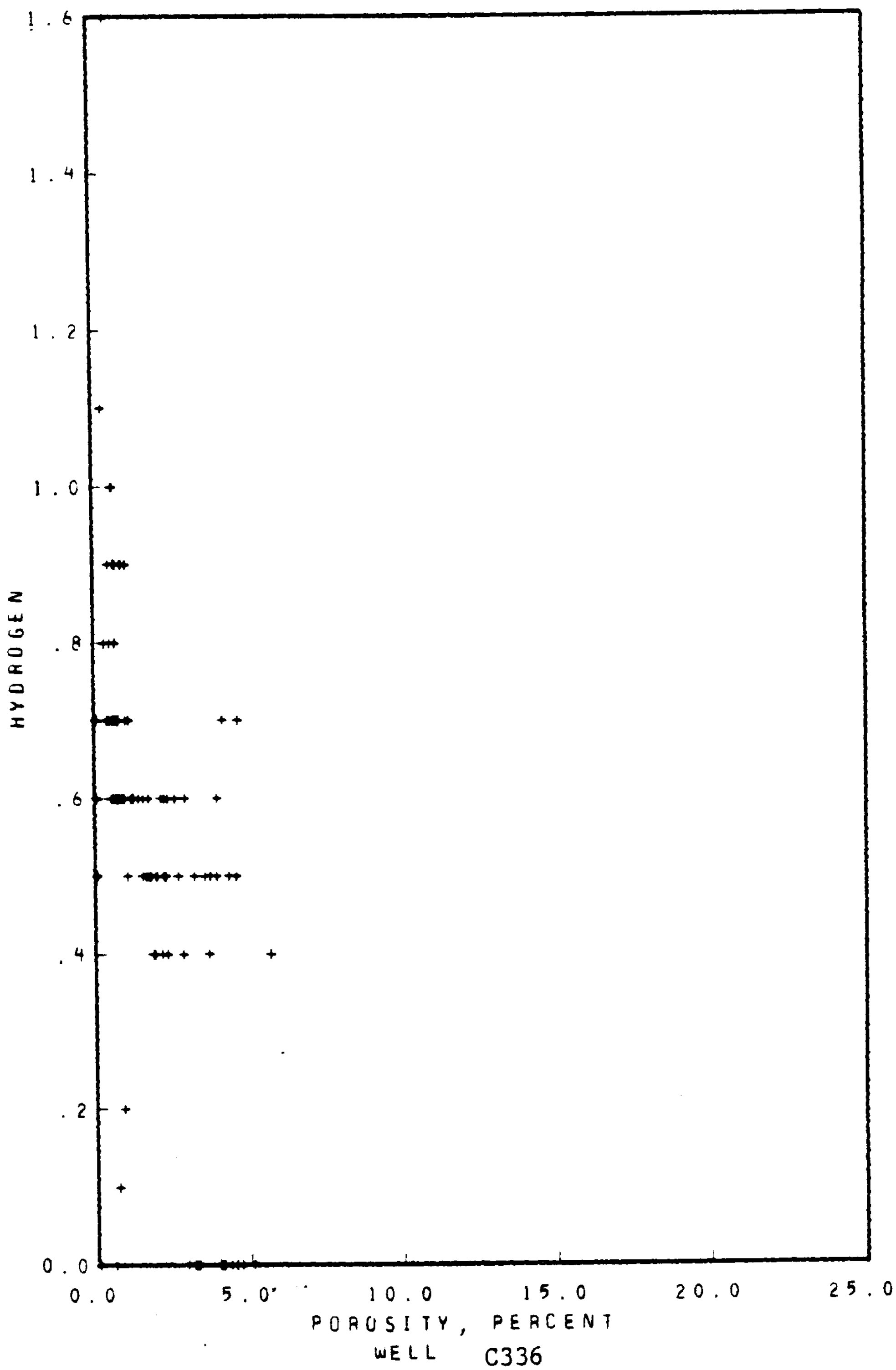
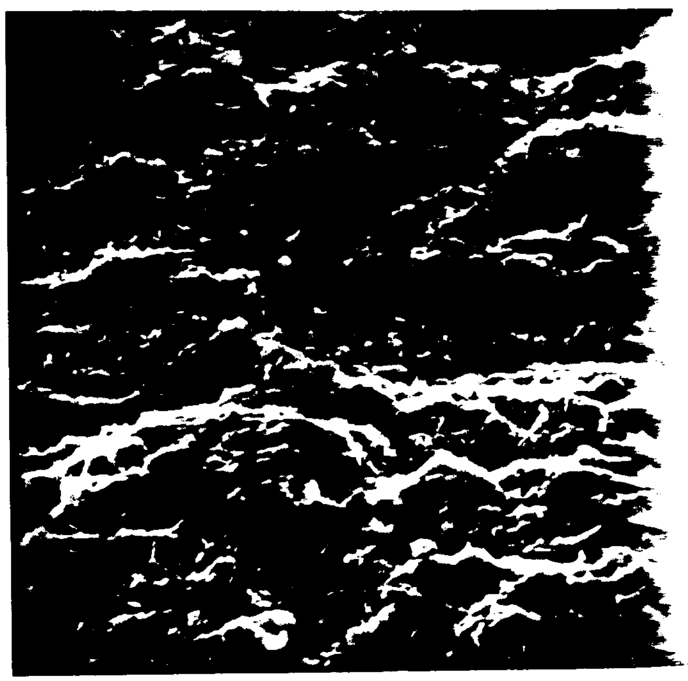
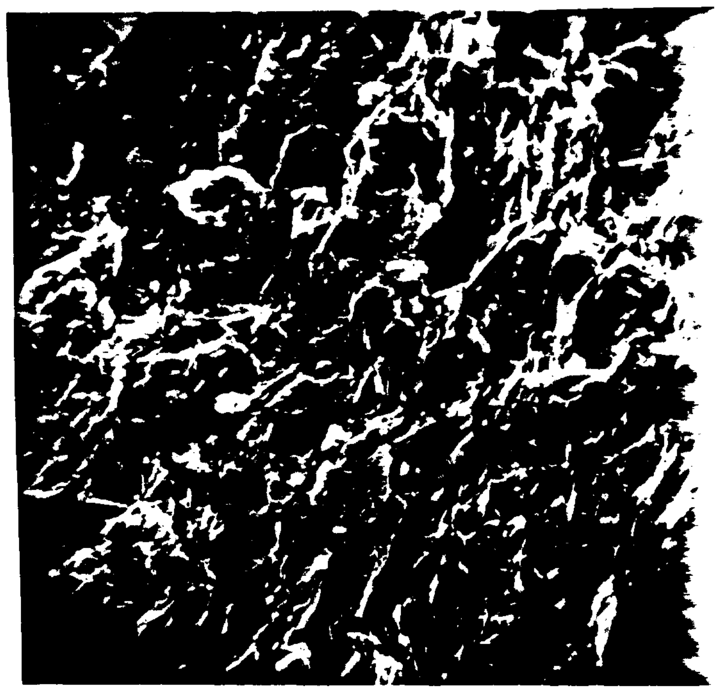


FIGURE 14. POROSITY VERSUS HYDROGEN FOR WELL C-336



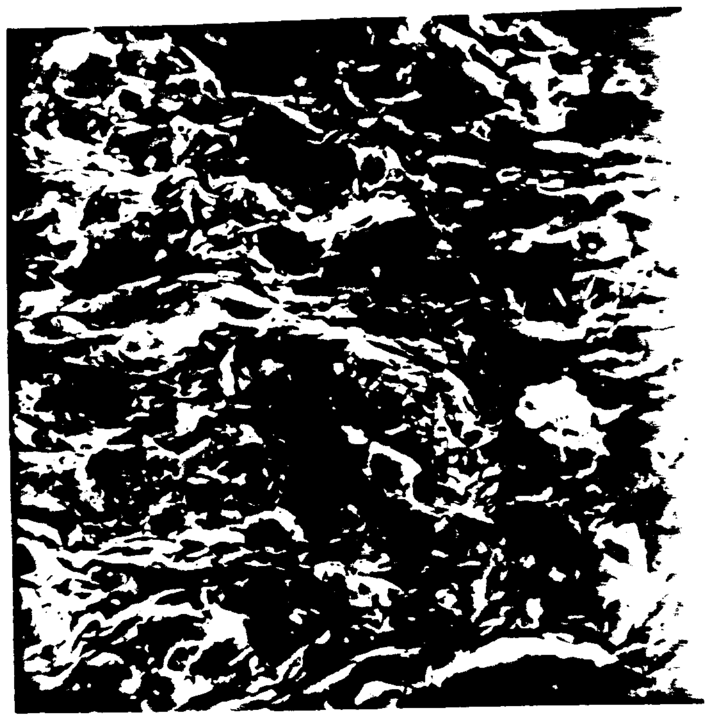
700X

FIGURE 15.
SEM MICROGRAPH OF SAMPLE C-336-3842



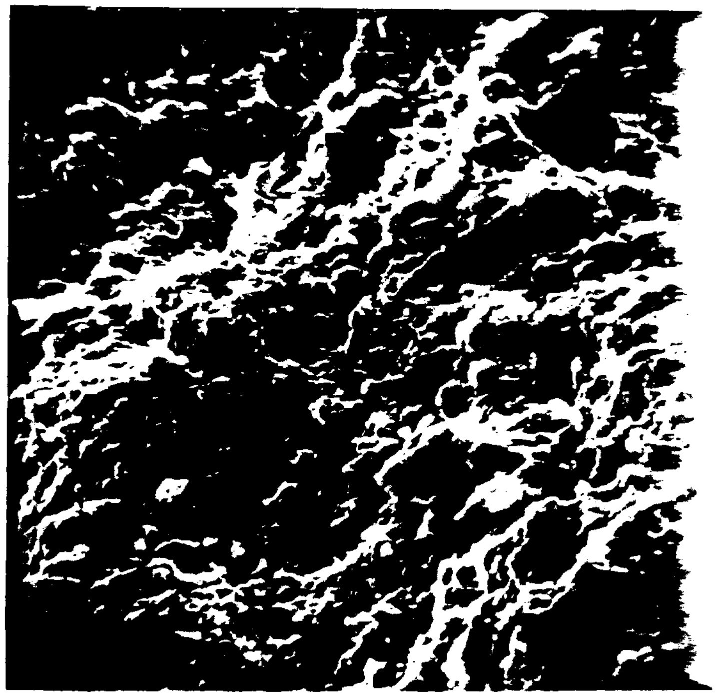
700 X

FIGURE 16.
SEM MICROGRAPH OF SAMPLE C-336-3315



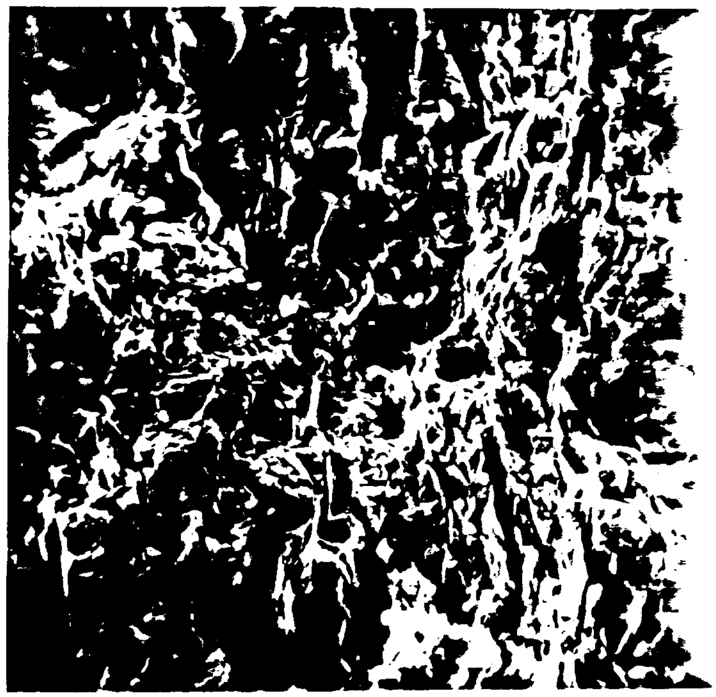
700 X

FIGURE 17.
SEM MICROGRAPH OF SAMPLE C-336-3186



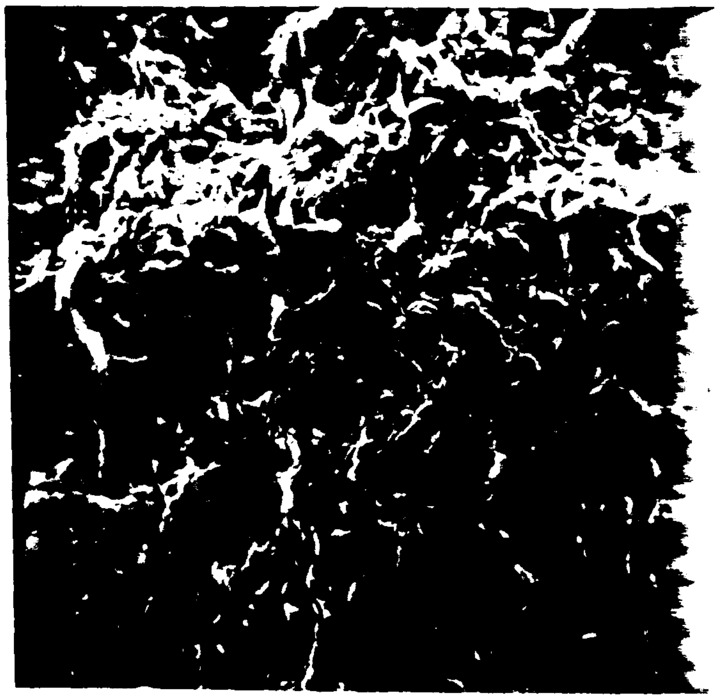
700 X

FIGURE 18.
SEM MICROGRAPH OF SAMPLE C-336-2990



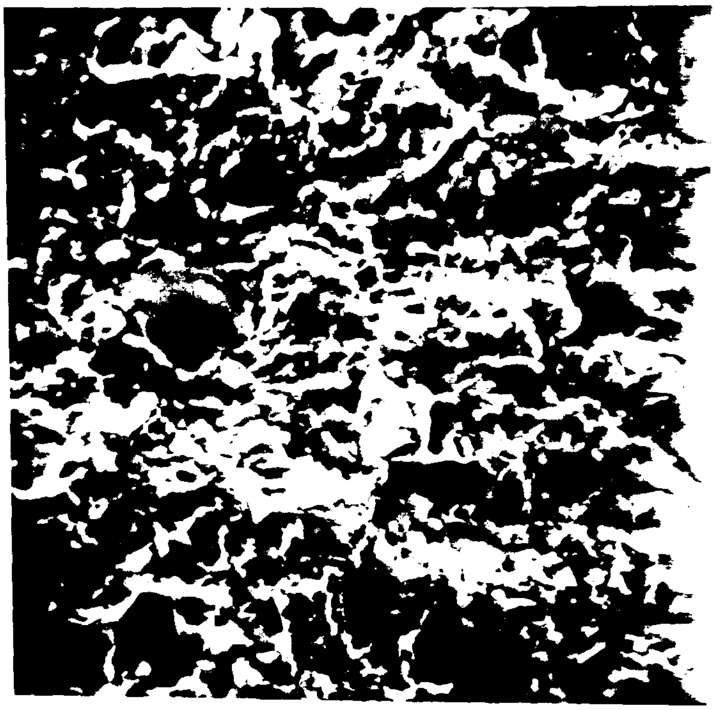
700 X

FIGURE 19.
SEM MICROGRAPH OF SAMPLE C-336-2763



700 X

FIGURE 20.
SEM MICROGRAPH OF SAMPLE C-336-2646



675 X

FIGURE 21.
SEM MICROGRAPH OF SAMPLE C-336-2524

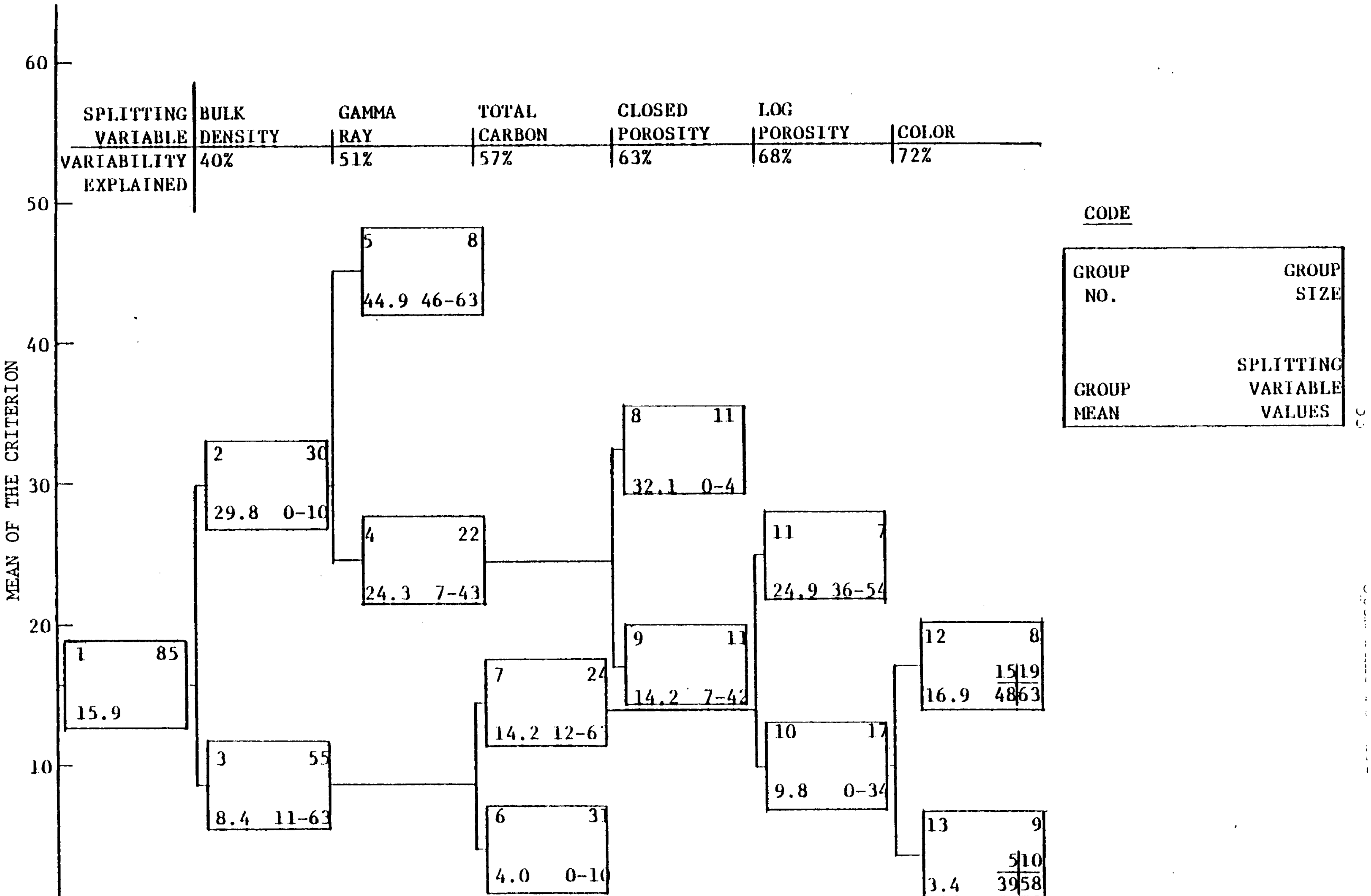


FIGURE 22. C-336 HYDROCARBON GAS VERSUS LABORATORY AND WELL LOG DATA

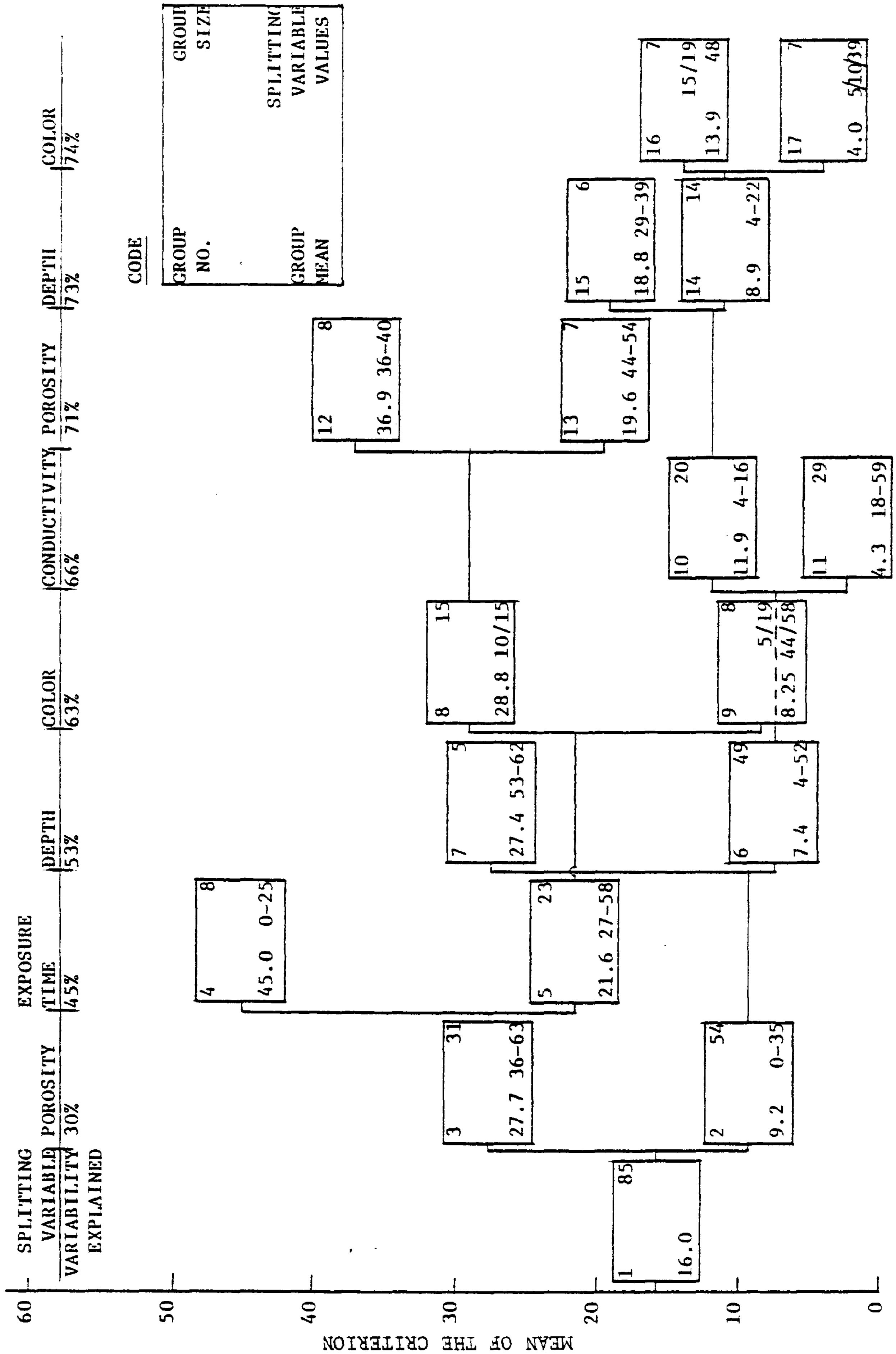


FIGURE 23. C-336 HYDROCARBON GAS VERSUS WELL LOG DATA

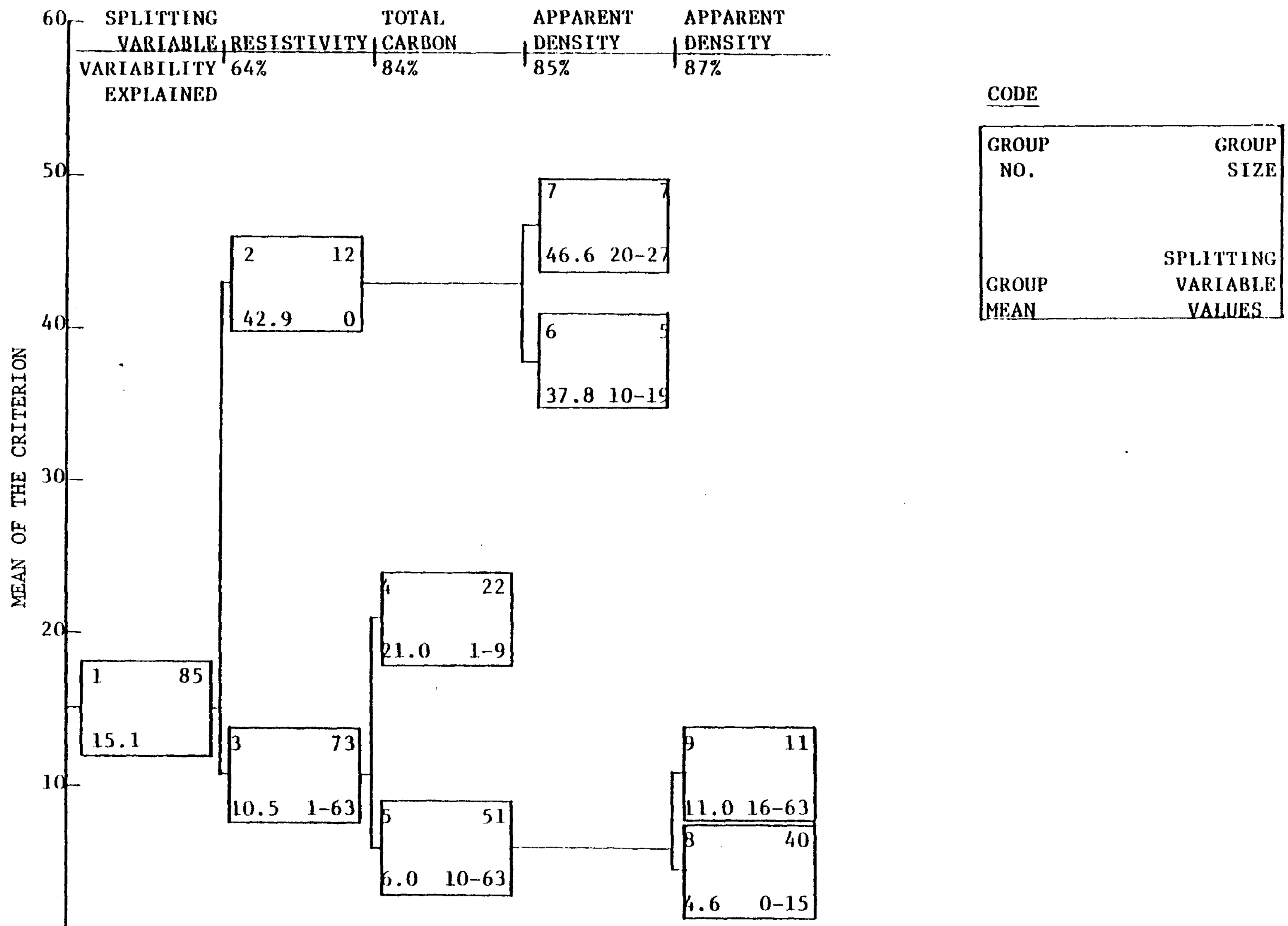


FIGURE 24. C-336 OPEN POROSITY VERSUS LABORATORY AND WELL LOG DATA

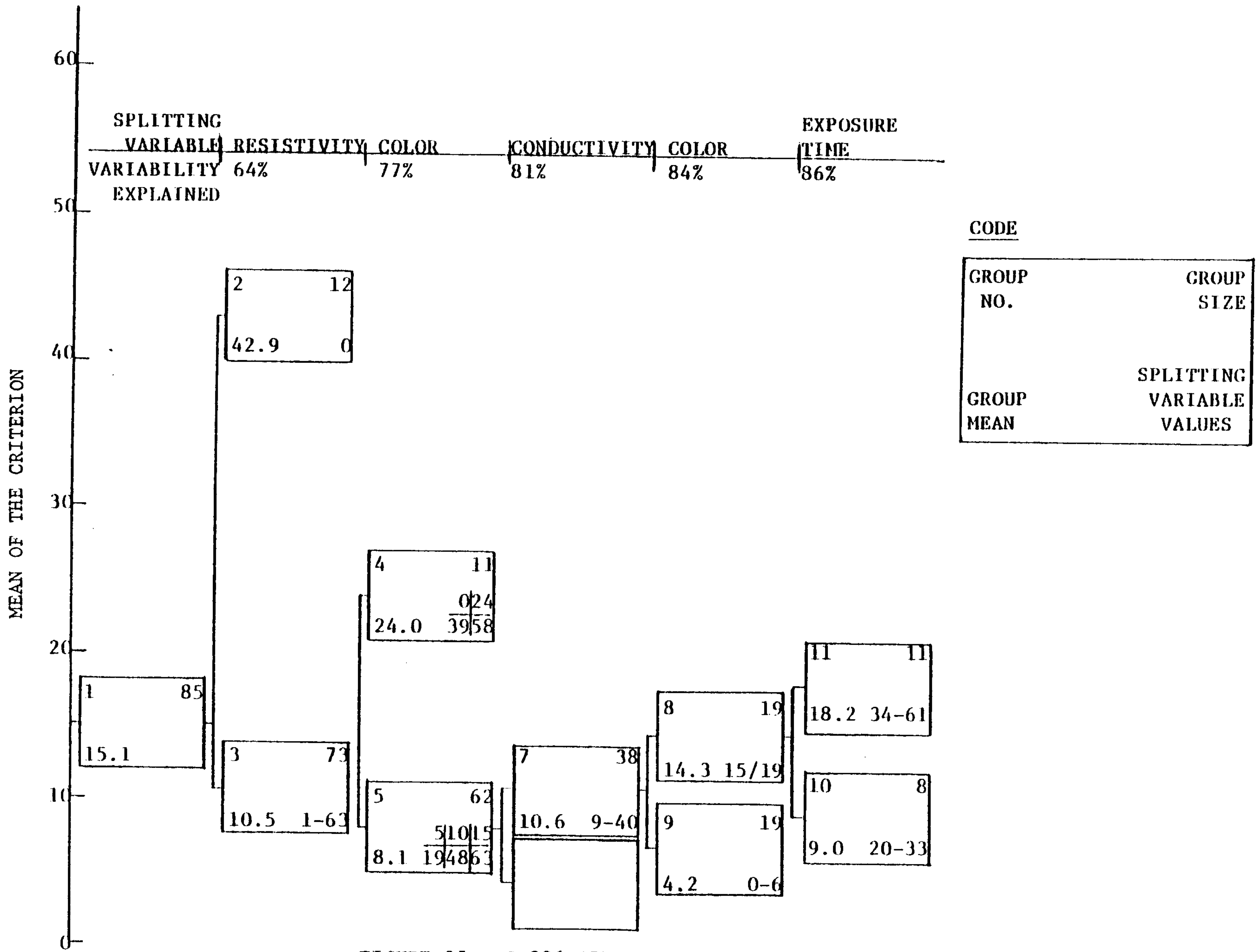


FIGURE 25. C-336 OPEN POROSITY VERSUS WELL LOG DATA